eum Library

FEB 19 1934

JOURNAL OF MAMMALOGY

199

Vol. 15 FEBRUARY, 1934 No. 1

AMERICAN SOCIETY OF MAMMALOGISTS

The American Society of Mammalogists

Founded April 3, 1919
Incorporated April 29, 1920

VERNON BAILEY, *President*
H. E. ANTHONY, T. S. PALMER, *Vice-Presidents*
ROBERT K. ENDERS, *Recording Secretary*
ROBERT T. HATT, *Corresponding Secretary*
MRS. VIOLA S. SNYDER, *Treasurer*
EDWARD A. PREBLE, *Chairman, Editorial Board*

Additional Directors

1932–1934
W. K. GREGORY
RUDOLPH M. ANDERSON
CHAS. C. ADAMS
H. H. T. JACKSON
LEE R. DICE

1933–1935
JOSEPH GRINNELL
REMINGTON KELLOGG
A. BRAZIER HOWELL
W. E. SAUNDERS
HAROLD J. COOLIDGE, JR.

C. HART MERRIAM
E. W. NELSON
WILFRED H. OSGOOD
GLOVER M. ALLEN
WITMER STONE
MARCUS W. LYON, JR.
} Past-Presidents

Trustees

H. E. ANTHONY (1931) W. K. GREGORY (1932) W. REID BLAIR (1933)

Standing Committees

Editorial: Edward A. Preble, *Chairman.* Glover M. Allen, Arthur H. Howell, Remington Kellogg, Gerrit S. Miller, Jr., George B. Wislocki.

Life Histories and Ecology: O. J. Murie, *Chairman.* R. K. Enders, William J. Hamilton, Jr., C. E. Johnson, E. Raymond Hall, Robert T. Hatt.

Anatomy and Phylogeny: A. Brazier Howell, *Chairman.* W. K. Gregory, Carl Hartman, Adolph H. Schultz, George B. Wislocki.

Bibliography: Gerrit S. Miller, Jr., *Chairman.* Lee R. Dice, Paul Moody, Arthur J. Poole, William L. Straus, Jr., Horace Elmer Wood, II.

Marine Mammals: T. S. Palmer, *Chairman.* Glover M. Allen, Remington Kellogg, Gerrit S. Miller, Jr.

Economic Mammalogy: Charles E. Johnson, *Chairman.* Junius Henderson, S. G. Jewett, Adolph Murie, M. P. Skinner, G. M. Wright.

Conservation of Land Mammals: H. E. Anthony, *Chairman.* Lee R. Dice, Madison Grant, Joseph Grinnell, T. S. Palmer.

Nomenclature: Wilfred H. Osgood, *Chairman.* Glover M. Allen, Arthur H. Howell, Gerrit S. Miller, Jr., T. S. Palmer.

Membership: Philip M. Blossom, *Chairman.* R. M. Anderson, Leo K. Couch, Joseph Dixon, Tappan Gregory, Lawrence M. Huey, W. P. Taylor, M. R. Thorpe.

The Journal of Mammalogy

Subscription rates, $4.00 per year; single numbers $1.00 each. Sent free to all members of the American Society of Mammalogists not in arrears for dues.

Subscriptions, changes of addresses, requests for missing numbers, applications for advertising rates, etc., should be sent to the corresponding secretary, Robert T. Hatt, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y.

Manuscripts for publication, books and papers for notice and reviews, etc., should be sent to Edward A. Preble, U. S. Biological Survey, Washington, D. C.

Entered as second-class matter, November 22, 1919, at the Postoffice, Baltimore, Md., under the Act of March 3, 1879.

Made in United States of America

JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists

VOL. 15 FEBRUARY, 1934 NO. 1

ARE RACIAL AND SPECIFIC CHARACTERS NON-MENDELIAN?

BY THEODOSIUS DOBZHANSKY

In an article published in a recent issue of this JOURNAL, Professor Castle (1933) asserts the existence of two qualitatively distinct types of inheritance. One is concerned with the easily classifiable characteristics, such as gross differences in the color patterns and length of hair, and the other involves the less striking but more widespread differences, such as size and proportions of the body. The first type is subject to Mendel's law and is based on transmission of genes, while the second is due to some unknown principle that Castle does not attempt to define. Since differences between races, species, and higher groups usually belong to the second type, it follows that the theory of the gene as it stands today has no bearing on problems of evolution. Being formulated by so great an authority as Professor Castle, these conclusions are bound to carry much weight in the eyes of wide circles of biologists, and therefore they should not be permitted to go unchallenged.

It is true that the inheritance of such characters as body size and body proportions has been little studied in mammals, and that in only few cases elsewhere is it possible to give a satisfactory account of the genic basis of such characters. When two races differing in body size are crossed, the F_1 generation is usually intermediate between the parents. The F_2 generation is likewise intermediate, but it manifests a higher degree of variability than the F_1. The range of variability observed in F_2 may or may not include those of both parental forms. In any case, by selection of proper variants in F_2 it is possible to recover the parental forms in the subsequent generations. This behavior of crosses is known as blending inheritance.

The interpretation of blending inheritance is the bone of contention. There is no doubt that blending inheritance must follow if the differences between the two races entering the cross are based on the action of several independent genes, each of which modifies the character in question by a certain small value. The greater the number of genes involved, and the more the character studied is subject to environmental variation, the less

clear and the more "blending" does the observable course of inheritance become. If this multiple factor interpretation of the nature of blending inheritance be accepted, then Castle's assumption of the existence of two qualitatively different types of heredity falls to the ground.

Castle is justified in stating that for a number of cases of blending inheritance, including cases in mammals studied by him, the multiple factor interpretation is a "hypothesis merely." Castle goes, however, much farther; he concludes that this interpretation is disproved by facts, and that the existence of non-Mendelian inheritance is established. These conclusions seem unwarranted. No scientific hypothesis can be proven for all cases to which it is applicable, because the number of such cases is virtually infinite. A hypothesis is tenable if it is proven to be correct in a certain number of typical instances, and if no facts are known that are contradictory to it. Are these requirements fulfilled by the multiple factor hypothesis?

Sturtevant (1918) has given a complete analysis in terms of genes of a case of blending inheritance of the bristle number in *Drosophila*. Morgan (1919) analyzed in similar terms the variations in the expression of the gene "notch" in *Drosophila* producing incisions on the wing margin. Dobzhansky (1927) and Masing (1928) studied genes in *Drosophila* modifying the shape of the spermatheca and the value of the costal index. The extensive work of Tedin (1925) on various quantitative characters in the plant *Camelina* has given a satisfactory proof of the validity of the multiple factor hypothesis. Philiptschenko (1928 and others) has carried the analysis of the quantitative characters in wheat probably farther than a similar analysis has been carried in any other object. He established a large number of definitely classifiable genic differences responsible for these characters.[1] The number of examples of this kind might be increased considerably. It is no exaggeration to say that in every case where blending inheritance has been sufficiently analyzed in favorable material, the results obtained are in accordance with the multiple factor hypothesis and with no other. Rodents can not be considered very favorable material for such studies, but even there Sumner saw no escape from adopting the multiple factor hypothesis.

Is there a single known instance of blending inheritance in which it is proven that something else besides multiple genes is involved? To my knowledge no instances of this kind have been established, and certainly no such evidence is adduced in Castle's paper. Castle's failure to discover a linkage between four color genes and the size genes in rabbit does not con-

[1] It should be noted that the late Professor Philiptschenko entertained a view on the nature of the blending inheritance essentially similar to that now held by Professor Castle. As a result of his work Philiptschenko adopted the multiple factor hypothesis and gave an excellent proof of it. He persisted, however, in believing that the differences between higher taxonomic groups (orders, classes, phyla) are non-genic in nature. A discussion of this topic is outside of the scope of the present note.

stitute a fair test. According to Painter (1926) the rabbit has eleven pairs of chromosomes. Even if some of the genes controlling body size were located, by a lucky chance, in the four chromosomes marked by the color genes, it is too much to expect that they should lie in such close proximity to the color genes that no separation due to crossing over should occur. It is not surprising then that the results of Castle's experiment are negative.

Another possible objection against the multiple factor hypothesis may be briefly considered here. Races of *Peromyscus*, of rabbits, and of livestock differ from each other in many quantitative characters, each of which shows blending inheritance. If every character is controlled by many genes, what is the total number of genes that we are forced to ascribe to the organism? Perhaps the number of genes thus arrived at is larger than the number of atoms in the chromosomes. This difficulty is imaginary. It is based on the wrong assumption that every gene is concerned with one and only one character. All we know about the effects of a gene is the effect of the difference between its dominant and its recessive allelomorphs. Only in very few cases (mainly in *Drosophila*) are we able to study individuals homozygous for absences (deficiencies) of genes, and thus get some information regarding the effects of the genes as such. It is highly significant that homozygous absences kill the organism in the earliest stages of development. It is at least probable that any one gene determines a great complex of very diverse characters, beginning with the size and proportions of the body, and ending with the development of brain and the heart.

REFERENCES

CASTLE, W. E. 1933. The incompleteness of our knowledge of heredity in mammals. Journ. Mamm., vol. 14, pp. 183–188.

DOBZHANSKY, TH. 1927. Studies on manifold effect of certain genes in Drosophila melanogaster. Zeit. indukt. Abst. Vererbl., vol. 43, pp. 330–388.

MASING, R. 1928. Die Vererbung der quantitativen Merkmale bei Drosophila melanogaster. Traveaux Soc. Nat. Leningrad, vol. 58, pp. 27–43.

MORGAN, T. H. 1919. A demonstration of genes modifying the character "notch." Carnegie Inst. Washington, publ. 278, pp. 343–388.

PAINTER, T. S. 1926. Studies in mammalian spermatogenesis VI. The chromosomes of the rabbit. Journ. Morphol., vol. 43, pp. 1–43.

PHILIPTSCHENKO, JUR. 1928. On imaginary cases of simple segregation. Bull. Bureau Genetics, vol. 6, pp. 1–32.

STURTEVANT, A. H. 1918. An analysis of the effects of selection. Carnegie Inst. Washington, publ. 264, pp. 1–68.

TEDIN, O. 1925. Vererbung, Variation und Systematic in der Gattung Camelina. Hereditas, vol. 6, pp. 275–386.

California Institute of Technology, Pasadena, California.

ON THE SIGNIFICANCE OF THE SUPRA-SYMPHYSIAL DEPRESSION AND GROOVE IN THE SHOVEL-TUSKED MASTODONTS

By William K. Gregory

In the remarkable shovel-tusked mastodont *Platybelodon grangeri* Osborn (fig. 1A) from Mongolia there is a large depression, hereinafter called the supra-symphysial depression, on the upper surface of the front part of the lower jaw, the anatomical significance of which has been in some doubt.

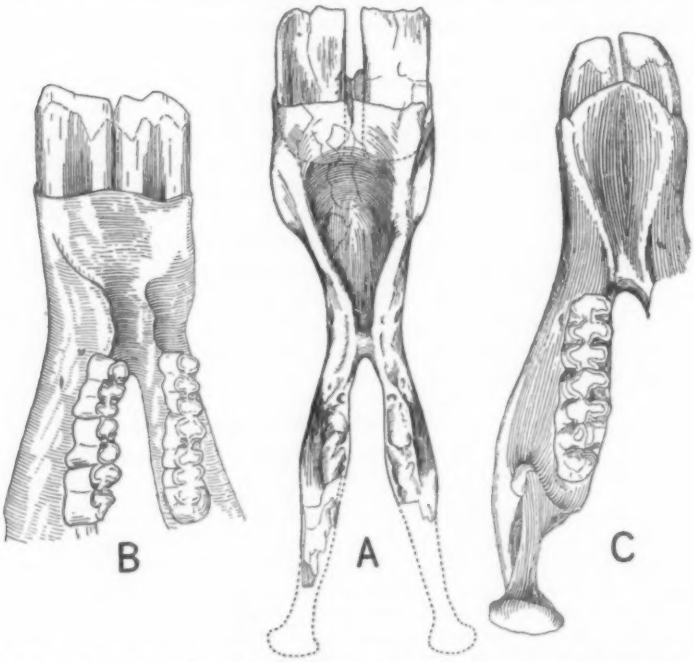


Fig. 1. The supra-symphysial depression and groove in the shovel-tusked mastodonts. A, *Platybelodon grangeri* Osborn; after Osborn. B, *Torynobelodon barnumbrowni;* after E. H. Barbour. C, *Serbelodon barbourensis;* after Childs Frick. All drawings by Miss Renee Strisoff. Not to scale.

Professor Osborn has interpreted it as a chamber for the reception of food, which he supposes was pushed back to the grinding teeth by the mobile trunk. In his restorations of *Platybelodon*, executed by Miss Margaret Flinsch, he has shown this region as devoid of a tongue, or at most with a very thin and weak tongue confined to the posterior part of the depression. As a result of the present investigation, however, there seems to be no reasonable

doubt that the tongue covered the whole floor of the supra-symphysial depression.

This evidence, as set forth in the illustrations, may be summarized as follows:

(1) The supra-symphysial depression and the groove behind it in all the shovel-tusked mastodonts imply the existence of a soft part with a convex

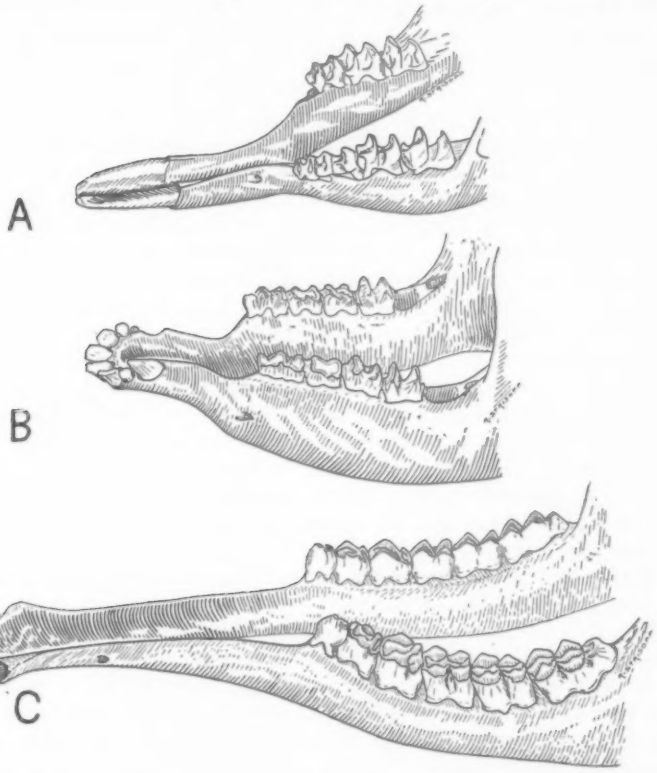


FIG. 2. The supra-symphysial depression and groove in recent mammals; oblique views, not to scale. A, Kangaroo; B, Tapir; C, Moose.

lower surface leading back to the space between the grinding teeth, which space was admittedly occupied by the tongue (fig. 1).

(2) A supra-symphysial depression and groove corresponding in position to those of the shovel-tuskers are largely occupied by the front part of the tongue in the kangaroo, tapir, moose, and other mammals examined (fig. 2).

In these animals the front part of the tongue lying in the supra-symphysial depression and groove is naturally continuous with the back part of the tongue lying between the opposite grinding teeth.

(3) The ridges, here named paraglossal ridges, bounding the supra-symphysial depression and groove on either side, lie between the tongue on the inner side and the buccinator mass on the outer side (fig. 3).

(4) In recent elephants (fig. 4) the fore part of the mandible ends in a vestigial supra-symphysial depression or groove, which is continuous posteriorly with the space between the grinding teeth. These conditions are less extremely specialized in the young (fig. 4A) than in the old mandible (fig. 4B). Comparison with the data assembled in figs. 3 and 4 leads to the inference that the vestigial supra-symphysial depression and groove are occupied in the living animal by the lower surface of the tongue.

(5) The foregoing inference is fully confirmed by the fact recorded by Doctor Eales (1926) that in the foetal African elephant (fig. 5) the lower side of the tongue entirely fills the supra-symphysial depression and groove, thus adding the recent elephants to the list of animals in which the depression and groove in question were occupied by the lower surface of the tongue.

(6) Comparison of the symphysial region of *Palaeomastodon* and *Phiomia* (fig. 6) with those of other mammals (figs. 2, 3) and with their modern relatives (fig. 4) can leave no reasonable doubt that in these ancestral proboscidians the supra-symphysial depression and groove were occupied by the lower surface of the tongue, which extended forward in the usual way to cover at least the proximal part of the procumbent lower incisors.

(7) My colleague, Mr. H. C. Raven, notes that in all his experience in the field and in the laboratory he has never seen any kind of terrestrial mammal in which the tongue did not extend at least as far forward as the rims of the bony alveoli of the lower incisors. In the *Platybelodon* these rims lie in front of the supra-symphysial depression.

Thus the evidence establishes the high probability that in the ancestors of the platybelodonts the supra-symphysial depression and groove were occupied by the lower surface of the anterior part of the tongue in the normal way and that even in the excessively specialized modern elephants the corresponding depression and groove, although now almost vestigial in the adult, are still occupied by what remains of the fore part of the tongue. Hence it would require the most direct and unequivocal evidence to show that the supra-symphysial depression and groove in the shovel-tuskers were occupied by anything but the tongue and its associated muscles, glands and blood-vessels.

There is nevertheless a remaining difficulty to be met. In *Platybelodon grangeri* (fig. 1A) the supra-symphysial depression is relatively immense, while the groove behind it is relatively very narrow and shallow. Moreover, the groove is borne by a conspicuous prominence formed by the posterior

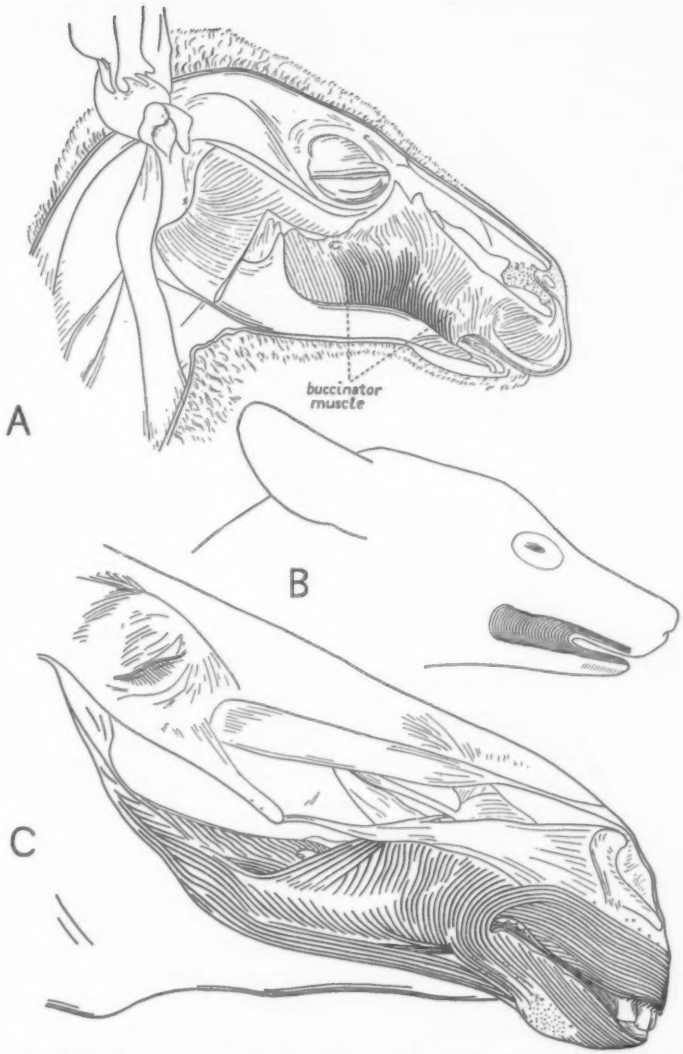


FIG. 3. Dissections of faces of mammals adapted from Boas and Paulli, showing the position of the buccinator muscle, which is lateral to the paraglossal crest and lingual groove. A, Kangaroo; B, Dog; C, Horse.

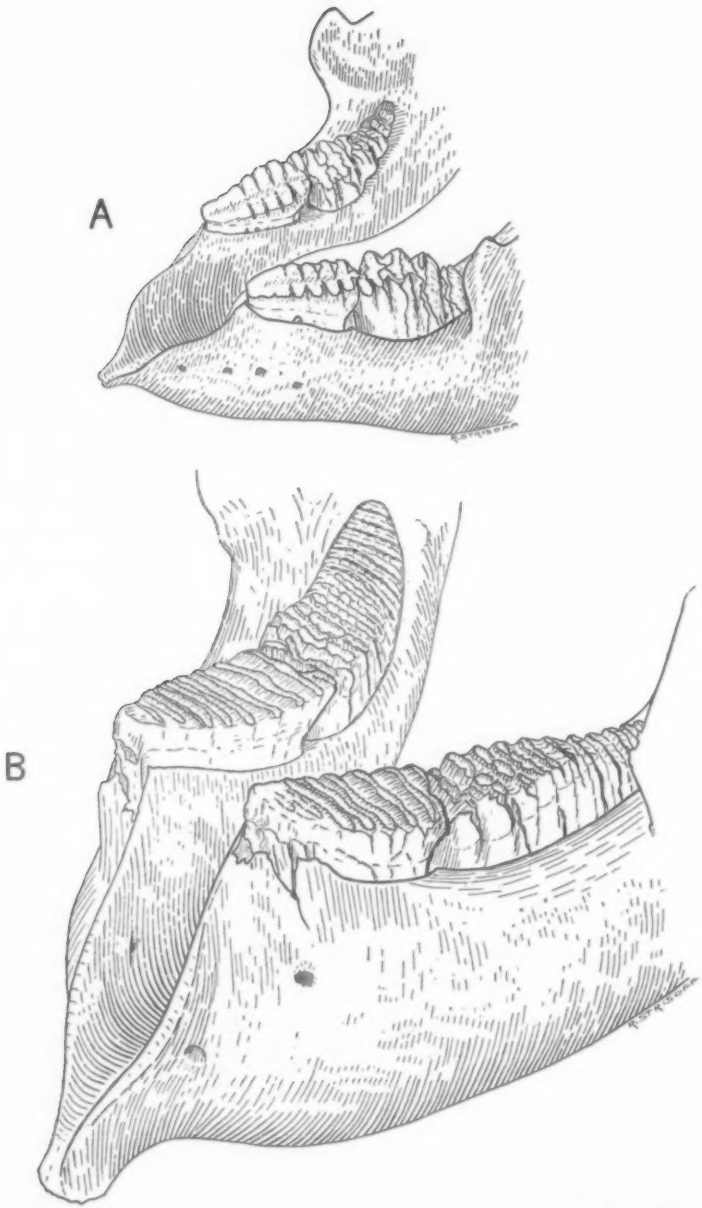


FIG. 4. Vestiges of the supra-symphysial depression and groove in the recent Indian elephant; not to scale. A, Young specimen showing relatively horizontal position of the vestigial supra-symphysial depression and large groove. B, Adult specimen showing sharp deflection of same.

border of the symphysis and probably serving to stiffen the very long mandible transversely. This prominence sharply separates the intermandibular space from the supra-symphysial depression. It has been suggested that the tongue ended anteriorly at the lingual groove and that the supra-symphysial depression was covered only by the gum. But this hypothesis may be met with all the evidence presented above and by the fact that the lingual groove, although narrow and shallow, is guarded laterally by the paraglossal crests and that it connects the supra-symphysial depression with the intermandib-

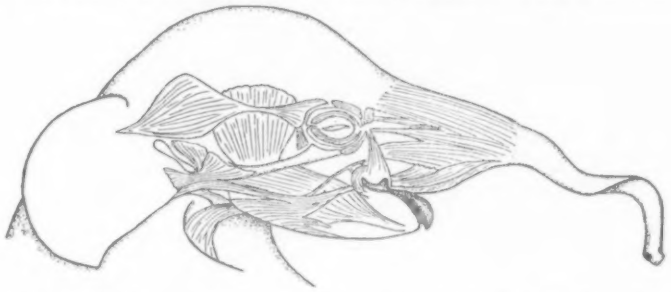


FIG. 5. Superficial musculature of the face and trunk of a foetal African elephant, showing the relatively long tongue lying in the supra-symphysial groove; after Eales.

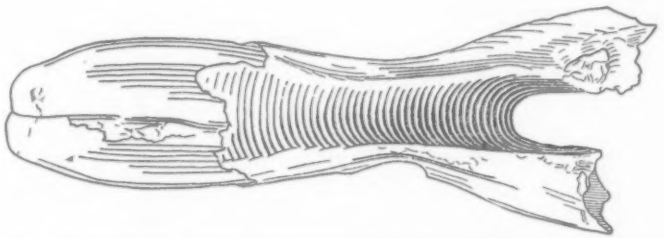


FIG. 6. *Palaeomastodon wintoni* Andrews; after C. W. Andrews. Fore part of mandible showing supra-symphysial depression, groove and paraglossal crests.

ular space; also that *Torynobelodon* (fig. 1B) clearly indicates that the tongue continued past the anterior cheek teeth between the paraglossal crests and then expanded distally to cover the widened incisors. Comparison of *Platybelodon* with *Torynobelodon* suggests that in the former the tongue consisted of two well differentiated regions: (a) the supra-symphysial or anterior portion, coöperating with the trunk and tongue proper in taking and receiving the food, and (b) the interramal division, whose function was to push the food between the upper and lower molars and afterward to attend to its deglutition.

According to this hypothesis, the pit in front of the transverse rounded symphysial eminence may have served for the insertion of a special anterior slip of the genioglossus muscle concerned with the operation of the anterior portion of the tongue (fig. 7).

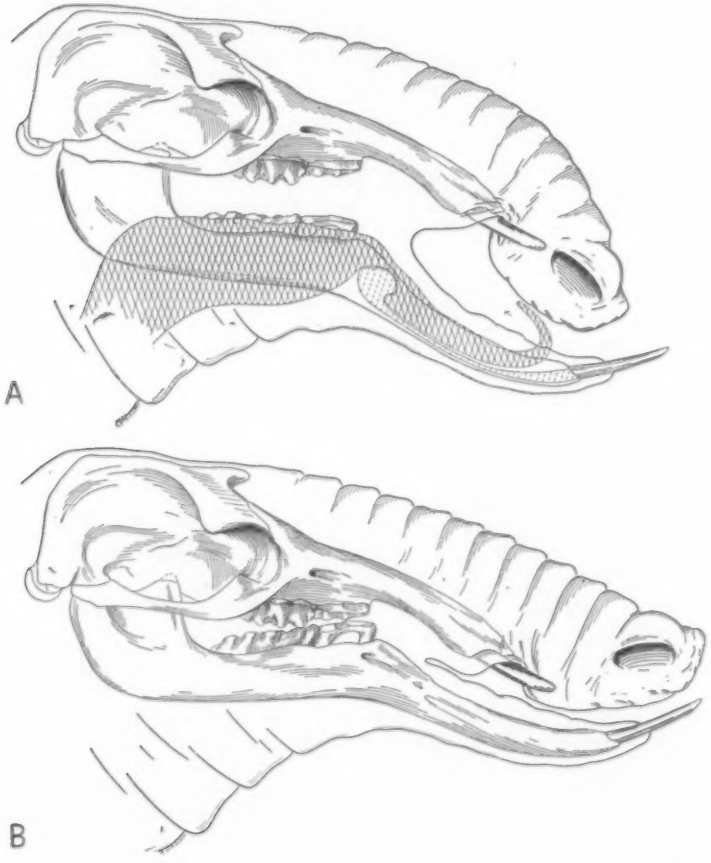


FIG. 7. Skull and mandible of *Platybelodon grangeri;* after Osborn, but with trunk, tongue and lips restored by present author.

In A the tongue is restored in optical section, showing its inferred relations to the symphysis (sectioned) and its differentiation into two functionally different parts. In B the trunk is restored in the resting position, showing its inferred relations to the lower incisors and lower lips.

If we look outside of the ungulates for a tongue that is sharply differentiated into anterior and posterior divisions connected by a narrow intermediate portion, we shall find a remarkably close convergence to the *Platybelodon* condition in the duck-billed platypus (*Ornithorhynchus anatinus*). Here the entire mandible is curiously suggestive of that of *Platybelodon*; the anterior part of the tongue lies in the supra-symphysial depression between the paraglossal ridges and is connected posteriorly with the broad interramial part of the tongue which presses the food against the palate and horny cheek plates.

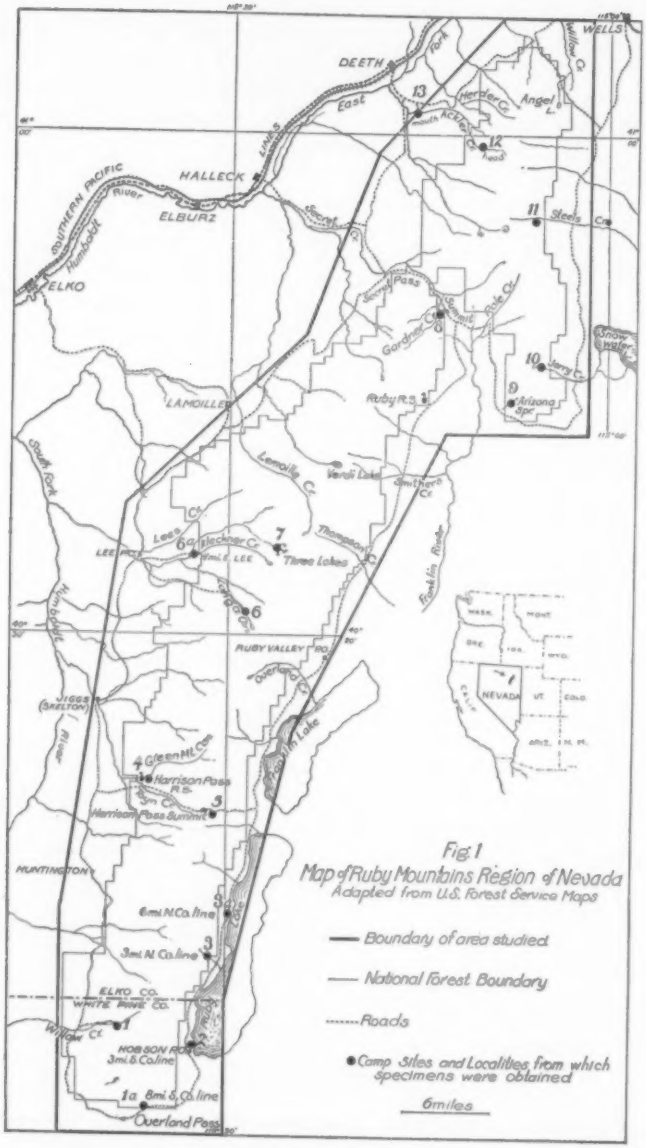
FIG. 8. Sketch restoration of head of *Platybelodon*.

In conclusion, the considerations advanced above lead to the inference that the fore part of the tongue of the *Platybelodons* instead of being absent or reduced was so enormously developed that the tongue was divided functionally into two parts, the anterior part concerned with the reception of the food, the posterior part concerned with mastication and deglutition in the usual way.

REFERENCES TO LITERATURE

ANDREWS, C. W. 1906. Descriptive catalogue of the Tertiary vertebrata of the Fayûm, Egypt. British Museum, London. 4to.

BARBOUR, ERWIN H. 1932. The mandible of *Torynobelodon barnumbrowni*. Amer. Journ. Sci., Ser. 5, vol. 24, no. 141, pp. 214–220, 3 figs.


DEETH
WELLS
HALLECK
ELBURZ
ELKO
LAMOILLE
RUBY VALLEY
JIGGS (SADLTON)
HUNTINGTON
Harrison Pass
Harrison Pass Summit
Overland Pass
Three Lakes
Ruby R.S. 1
Arizona Spr.
Very Cr.
Steels Cr.
Angel L.
Herder Cr.
Gardner Cr.
Lemoille Cr.
Verdi Lake
Smith Creek
Thompson Cr.
Franklin River
Green Mt. Cr.
Overland Cr.
Huntington River
South Fork
Humboldt River
Lewis
Secret Pass
Rock Cr.
Willow Cr.
Snow Water Lk.
Lee
Lee Pass
Fleckner Cr.
Carlin Canyon
Ruby Lake
6 mi N. Co. line
3 mi N. Co. line
3 mi S. Co. line
8 mi S. Co. line
ELKO CO.
WHITE PINE CO.
HOBSON RD.
Willow Cr.
NEVADA
WASH.
MONT.
ORE.
IDA.
WYO.
CALIF.
UTAH
COLO.
ARIZ.
N. MEX.
Fig. 1
Map of Ruby Mountains Region of Nevada
Adapted from U.S. Forest Service Maps
Boundary of area studied
National Forest Boundary
Roads
Camp Sites and Localities from which specimens were obtained
6 miles

The only mammal of the Ruby Mountains not known to occur elsewhere is *Ochotona princeps nevadensis*. This scarcity of endemic forms would hardly be expected when one considers that the range is fairly well isolated. However there are few, if any, other forms, which, like the pika, find suitable living conditions exclusively in the higher parts of the range.

LIFE ZONES AND HABITATS

In general the Ruby Mountains present Boreal conditions, but certain areas are in the Transition Zone, and a few limited sections may be classed as Upper Sonoran. The life zones of the Ruby Mountains are not easily definable, since the species of plants and animals which usually are considered to be characteristic of certain life zones are distributed more nearly in relation to slope exposure and water supply than to altitude. For example, above Three Lakes, at an elevation of 10,000 feet, there is an extensive west-facing slope which presents Transition Zone characteristics in that it is covered with sagebrush, and here in July, 1928, we found least chipmunks, sagebrush voles (*Lagurus*), ground squirrels (*Citellus elegans nevadensis*), sage thrashers, and Brewer sparrows, all species usually found in the Transition Zone. This slope did not present exceptional features, as similar conditions were found commonly along the higher and more exposed slopes.

In contrast to this is the condition found along the cold, rapidly running mountain streams where many typically Boreal species are found at altitudes as low as 6100 feet. The dominant plant along these streams is aspen (*Populus aurea*). Representatives of the Canadian and Hudsonian zones, such as wandering shrew, water shrew, jumping mouse, olive-backed thrush, dusky grouse, fox sparrow, and Cassin purple finch are found along nearly all of the streams, even at 6100 feet altitude.

Certain species which over most of the Great Basin inhabit primarily the Upper Sonoran Zone are found only in the lowest portions of our territory, and then only in restricted areas and in limited numbers. Representatives of this group are pigmy rabbit, black-tailed jackrabbit, short-tailed grasshopper mouse, harvest mouse, canyon mouse, lark sparrow, Bullock oriole, western mockingbird, Cassin kingbird, and California linnet.

The above data indicate that the Ruby Mountains are spotted or streaked vertically by life zones, rather than belted horizontally in the usual manner. The Ruby Mountains are about eighty miles long and show noticeable zonal differences at the two ends of the range; the northern end is the more Boreal in character.

We have considered the following habitats found within our area as distinctive, and have listed them in order of the elevation at which they were generally found.

1. **Marsh.** Ruby Lake is in reality not a lake, but an extensive shallow marsh about sixteen miles long and from one to four miles wide. The water in the lake is practically fresh, although there is no visible outlet. It is fed by numerous springs, most of which are on the west side. Most of the lake freezes over during the winter, but the springs, as well as the streams which originate from them, remain open and keep parts of the lake from freezing.

Dominant plants: Tule (*Scirpus acutus*), spear grass, and a few willows.

Characteristic mammals: Although a favorite resort for many varieties of birds, the marsh is the home of only four species of mammals: *Microtus montanus montanus*, *Ondatra zibethica mergens*, and a few *Peromyscus maniculatus sonoriensis* and *Sorex vagrans amoenus*.

2. **Meadows,** at low altitudes. These occur commonly along the lower parts of the streams and about Ruby Lake.

Dominant plants: Grasses of several species.

Characteristic mammals: *Citellus elegans nevadensis, Lepus californicus deserticola,* and *Lepus townsendii townsendii.*

3. **Sagebrush.**

Dominant plants: Almost a pure stand of sagebrush (*Artemisia tridentata*), occasionally some antelope brush (*Purshia tridentata*), service berry (*Amelanchier utahensis*), and grasses.

Characteristic mammals: *Eutamias minimus pictus, Lepus californicus deserticola, Sylvilagus idahoensis* and *Perognathus parvus olivaceus.*

4. **Rimrock.** Rimrock occurs along canyons throughout the range, but especially at the lower altitudes in the southern portion of the range (see pl. 3).

Dominant plants: Mountain mahogany (*Cercocarpus ledifolius*), pinyon pine (*Pinus monophylla*), juniper (*Juniperus utahensis*), sagebrush (*Artemisia tridentata*) and some grasses.

Characteristic mammals: *Neotoma cinerea cinerea, Eutamias quadrivittatus inyoensis, Peromyscus crinitus crinitus, Peromyscus truei truei* and *Lynx rufus pallidus.*

5. **Tree covered slopes,** 7000 to 8000 feet altitude, especially as found in the southern part of the range.

Dominant plants: Pinyon pine, juniper, and mountain mahogany.

Characteristic mammal: *Odocoileus hemionus hemionus* (in fall of the year).

6. **Brushy canyons.**

A. Brushy canyons at the lower altitudes, especially as found in the southern portion of the range.

Dominant plants: Willow, chokecherry (*Prunus melanocarpa*), service berry, currant, sagebrush, wild rose, and grasses.

Characteristic mammals: *Microtus mordax mordax, Lagurus curtatus intermedius, Zapus princeps nevadensis, Perognathus parvus olivaceus, Peromyscus maniculatus* and *Sylvilagus nuttallii grangeri.*

B. Brushy canyons, of the northern part of the range.

Dominant plants: Aspen, chokecherry, *Ceanothus,* twinberry, and antelope brush.

Characteristic mammals: *Zapus princeps nevadensis, Microtus mordax mordax, Callospermophilus chrysodeirus trepidus* and, along streams, *Sorex vagrans amoenus* and *Sorex palustris navigator.*

7. **Rocky outcrops** and **talus slopes,** above 8000 feet altitude.

Dominant plants: Limber pine (*Pinus flexilis*), prostrate juniper (*Juniperus siberica*), grasses, and low-growing herbs.

Characteristic mammals: *Marmota flaviventris avara, Neotoma cinerea cinerea* and, in talus only, *Ochotona princeps nevadensis.*

Other distinctive habitats are high mountain meadows (wet or frozen most of the year), the shores of high mountain lakes, and pure stands of aspen on moist slopes (8000 to 10,000 feet altitude). None of these habitats provide all of the requirements of any one of the species of mammals found in the Ruby Mountains, and therefore no mammals habitually live in any of them.

The habitat that harbors the largest number of mammals, both species and individuals, is the type found along slowly flowing streams, where the climate is comparatively mild, the slopes gentle, and where there is a good growth and variety of vegetation (see pl. 2). The best examples of this type of habitat were found in Green Mountain, Willow, and Ackler Creek canyons, where habitats no. 2 and no. 6 are combined.

PERSONNEL AND METHODS EMPLOYED

Those who took part in the field work of the survey of the Ruby Mountains were: Bernard Bailey, Adrey E. Borell, Raleigh A. Borell, Lawrence V. Compton, Ralph

Ellis, Raymond M. Gilmore and Harry H. Sheldon. Our note-books record 8603 "trap nights" (one trap set one night) during the survey. There were 391 "man days" (one man in the field one day) spent while working the area.

The inclusive dates during which at least one member of our party worked continuously within the area are as follows: July 1 to August 12, and December 13 to 31, 1927; May 19 to August 14, 1928; May 21 to July 9, and October 12 to November 6, 1929. Thus opportunity was afforded to observe conditions at various seasons of the year.

The altitudes given here for our collecting stations were ascertained by use of an aneroid barometer, averaging ten or more readings taken on as many days. Other altitudes given in the text are estimates based on the altitudes which we determined for each camp site.

As regards the joint authorship, both of us participated in the field work. The senior author prepared the original manuscript. The junior author financed the work, and critically edited the entire manuscript, giving special attention to the introductory part. Photographs were taken by the senior author. Nine hundred forty-two specimens of mammals, including skins and skeletons, were preserved. These are in the private collection of Ralph Ellis, save 40 specimens placed in the collection of the Museum of Vertebrate Zoology, University of California. All catalogue numbers, unless otherwise specified, refer to specimens in the Ellis collection. The plants have been donated to the herbarium at the University of California, Berkeley. All of the amphibians and reptiles and a few of the birds have been donated to the Museum of Vertebrate Zoology, University of California, Berkeley. The crops and stomachs of a number of specimens were sent to the United States Bureau of Biological Survey, where the contents were identified and preserved. The majority of the birds are in the collection of Ralph Ellis.

COLLECTING LOCALITIES

A list of our camps and other collecting localities, with inclusive dates, arranged in order from south to north, are given below (see map on page 14). No camps were established at localities 1a, 3a, and 6a, where specimens were collected on side trips.

1. Willow Creek, White Pine County, 2 miles south of Elko County line, 6500 feet (estimated); May 21–June 9, 1929.
1a. Overland Pass, east slope of Ruby Mountains, White Pine County, 8 miles south of Elko County line.
2. West side of Ruby Lake, White Pine County, 3 miles south of Elko County line, 6100 feet; October 12–November 6, 1929.
3. West side of Ruby Lake, Elko County, 3 miles north of White Pine County line, 6200 feet; July 14–August 12, 1927; December 13–December 31, 1927; May 10–June 6, 1928.
3a. West side of Ruby Lake, Elko County, 6 miles north of White Pine County line.
4. Harrison Pass Ranger Station, Green Mountain Canyon, 6050 feet (west entrance of Harrison Pass); June 7–July 1, 1928.
5. Summit of Harrison Pass, 7400 feet; June 13, 1929.
6. Long Creek, 7830 feet; July 4–July 20, 1928.
6a. Kleckner Creek, 4 miles east of Lee, Elko County.
7. Three Lakes, 9740 feet; July 22–August 14, 1928.
8. Summit of Secret Pass, 6200 feet; July 1–July 13, 1927.
9. Arizona Springs, 6500 feet (estimated); June 22, 1929.
10. Jerry Creek (Jerry Crab Springs), 6700 feet; June 23–June 29, 1929.
11. Steels Creek, 7000 feet (estimated); June 14–June 21, 1929.
12. Head of Ackler Creek, 6800 feet; July 1–July 8, 1929.
13. Mountain View, mouth of Ackler Creek, June 30, 1929, and July 9, 1929.

ACKNOWLEDGMENTS

We are especially indebted to Prof. E. Raymond Hall, who assisted with the identification of certain specimens and who also rendered critical assistance in preparation of parts of the manuscript.

We are greatly obliged to Dr. Joseph Grinnell, Director of the Museum of Vertebrate Zoology, University of California, who has freely given his time and advice whenever called on. For the loan of comparative materials in addition to those in the Museum of Vertebrate Zoology, University of California, we are indebted to the authorities in charge of the collections of the United States National Museum and the Bureau of Biological Survey, U. S. Department of Agriculture. We owe thanks also to the late Donald R. Dickey of Pasadena, California, and to Mr. Stanley G. Jewett of Portland, Oregon, for the loan of specimens from their collections.

Credit is due Dr. Herbert L. Mason of the Department of Botany, University of California, who was in the region with us for two weeks collecting botanical specimens, and who identified our plant material.

Through Mr. W. L. McAtee, in charge of the Division of Food Habits of the United States Bureau of Biological Survey, we received identification of the stomach and crop contents of birds and mammals.

The residents of the region were most cordial, and rendered much valuable assistance. In this connection we must mention especially Mr. Hayden Henderson of Elko, and Mr. August Rohwer and Mr. William Toyn of the United States Forest Service. Others who assisted in the procuring of desirable specimens and who extended other special courtesies to us were Mr. C. H. Kleckner, Mr. Sam Davis, Mr. George Green and Mr. Harry Hagar.

ACCOUNTS OF SPECIES

Sorex vagrans amoenus Merriam

Wandering Shrew

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Three Lakes, and Summit of Secret Pass. Thirty specimens.

Wandering shrews were widely distributed and not uncommon in the Ruby Mountains. However, they were localized about the springs, lakes, and streams which provided their only suitable habitats. Extensive trapping about Ruby Lake (6000 feet) during the summer did not produce a single shrew. However, eight were caught in this same area during the latter part of December. At this time the ground was covered with snow and the nightly temperature was little above zero Fahrenheit. Several of these shrews were taken in runways beneath the snow, in which meadow mice also were trapped. Some of the runways led over areas which, during the summer, were dry, sage-covered flats fifty yards or more from water. Each of the eight specimens mentioned in the above paragraph has the teeth only slightly worn, which indicates that the animals are young.

Wandering shrews have a strong characteristic odor. Often a trap which caught one shrew captured others—probably because of the scent left on the trap. For example, on August 2, 1928, a female was captured beneath a log at the edge of a small lake. Three males were taken in this same trap on succeeding nights, while other traps set near-by in similar places were undisturbed.

Little information was gathered regarding the breeding habits of these shrews. Two

females were trapped on July 9 and 10, respectively, at 7800 feet; each had three pairs of active mammae. Several males taken during June showed enlarged testes.

Nine specimens which were taken between November 4 and December 31 are in winter pelage, which is longer, softer, and noticeably darker (less brownish) in color than it is in nineteen specimens taken between June 2 and August 6.

This species previously has been recorded from our area by Jackson (1928, p. 110) who lists three specimens from "Ruby Lake" and nine from the "Ruby Mountains."

The occurrence of *Sorex vagrans amoenus* in the Ruby Mountains as a colony apparently separated by nearly 230 miles (see Jackson, *op. cit.*, fig. 11, p. 102) from the main range of *amoenus*, led us to compare critically the 16 adult specimens from the Ruby Mountains which showed much wear on the teeth, with 10 specimens of *Sorex vagrans monticola* of similar age from the Seven Devils Mountains of Idaho, with 5 adult topotypes of *S. v. amoenus*, and with 10 topotypes or near topotypes of *S. v. nevadensis* of varying age. In average tail length our specimens are exactly intermediate between *amoenus* and *monticola*; in total length they are nearer to *monticola;* the tooth-bearing part of the skull is smaller than in *monticola* and is about as in *amoenus*. In longitudinal axis the contour of the dorsal face of the skull in *monticola* is relatively straight, whereas in *amoenus* the brain case rises more abruptly from the anterior part of the skull. In this respect, the Ruby Mountains specimens are decidedly nearer to *monticola*. As regards interorbital breadth, taken as by Hall and Gilmore (1932, p. 395) our specimens average less than in any of the three surrounding races—*amoenus*, *monticola*, and *nevadensis*. The greater attenuation of the rostrum ascribed by Jackson (*op. cit.*, p. 107) to *Sorex vagrans nevadensis* is barely appreciable in our material of this race. However, the Ruby Mountains series shows no approach to *nevadensis* in this respect.

In review, although the Ruby Mountains series is intermediate between *amoenus* and *monticola* and might, with almost equal propriety, be referred to either subspecies, in deference to Jackson's monographic treatment, we employ the name *amoenus*.

Average measurements in millimeters pertinent to the above discussion are as follows: First, 5 topotypes of *Sorex vagrans amoenus*; second, 16 specimens from the Ruby Mountains; third, 10 specimens of *Sorex vagrans monticola* from Idaho: Total length, 98, 107, 110; tail, 36, 39, 42; interorbital breadth of skull, 3.4, 3.1, 3.3.

Sorex palustris navigator (Baird)

Water Shrew

From Willow Creek; Harrison Pass Ranger Station; Long Creek; Three Lakes; Summit of Secret Pass; and Steels Creek. Twenty-seven specimens.

The water shrew was not at altitudes as low as was the wandering shrew, nor away from the immediate edge of running water. Its habitat is slightly more aquatic than that of the wandering shrew, but the habitats of the two animals overlap. Specimens of both were often caught in the same trap on successive nights. The water shrews preferred slowly moving streams bordered by willow and aspen, and along which were many fallen logs and accumulations of drift wood.

An adult female taken June 2, 1929, at 6200 feet altitude, contained six large embryos; the mammae of this specimen are two pairs abdominal and one pair inguinal.

Myotis lucifugus carissima Thomas

Yellowstone Little Brown Bat

From west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Three Lakes; and head of Ackler Creek. Thirty-five specimens.

Of the various bats found within our territory this one appeared to be the most numerous. Only 38 specimens of all the other species combined were taken. Nineteen specimens of *carissima* were shot as they foraged over Favre Lake, and 14 were taken as they flew about our camp on the west side of Ruby Lake. These two localities present extremes of altitude among our camp sites. It so happened that at these camp sites there were open areas especially suitable for shooting bats at dusk. At Favre Lake bats sometimes came in numbers, especially on warm, cloudless evenings, to forage over the lake and to drink. Most of those shot at Favre Lake fell into the water. On five occasions large rainbow trout (which have been planted there) swallowed the dead or crippled bats before we could retrieve them. As one member of our party was about to shoot a bat, it dipped to the surface of the lake, supposedly to drink, at which instant a trout broke the surface of the water and seized the bat.

Our specimens of this species vary greatly in color. One of them is as light as specimens of *M. l. phasma* from Inyo County, California, although its ears are darker than in any of the available specimens of *phasma*.

Myotis evotis chrysonotus (J. A. Allen)

Little Big-eared Bat

From Willow Creek and head of Ackler Creek. Two specimens.

Myotis volans interior Miller

Interior Long-legged Bat

From Willow Creek; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Three Lakes; and head of Ackler Creek. Nineteen specimens, collected at altitudes between 6100 and 9600 feet.

Myotis subulatus melanorhinus (Merriam)

Black-nosed Bat

From west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Arizona Springs; and head of Ackler Creek. Eight specimens.

Eptesicus fuscus fuscus (Peale and Beauvois)

Large Brown Bat

From Overland Pass and Three Lakes. Nine specimens.

On May 30, 1928, near the summit of Overland Pass (about 6600 feet altitude), we heard bats squeaking in a small cave near the top of a forty-foot cliff. A shot fired into this cave flushed approximately a hundred bats, apparently all of this species. Some of them flew directly into a small crevice in the same cliff about fifty yards from the cave. The next day we again visited this cliff and dislodged four individuals from the crevice, but were unable to locate a single bat in the cave. The eight bats procured from this cliff were females and four of them contained one small embryo each.

One other *Eptesicus*, an adult male, was shot at dusk on August 12, 1928, as it flew over Favre Lake, 9500 feet altitude. We saw a few other bats which, judging from their slow, even method of flying, were of this species.

Mustela arizonensis (Mearns)

Mountain Weasel

Weasels were recorded at various altitudes and in several habitats throughout the Ruby Mountains. Two were seen on dry sage-covered flats at about 6000 feet. The

only one we secured was shot on top of a rocky, barren ridge at an altitude of 11,000 feet. Between July 22 and August 14, 1928, four weasels were seen in the vicinity of Three Lakes. One of these caused a great disturbance among the chipmunks and ground squirrels as it sneaked about a small rock pile on a grassy slope. On July 10, 1927, two weasels were observed as one chased the other among a heavy stand of aspen and brush at the edge of Secret Creek near the summit of Secret Pass. On June 12, 1929, two weasels were seen together near the summit of Harrison Pass. In late December, 1927, two weasels in white winter coat were seen on the west side of Ruby Lake, 3 miles north of the White Pine County line.

Mustela vison energumenos (Bangs)

Mink

We saw no mink, but local trappers told us that occasionally they caught mink along the streams and about Ruby Lake.

Spilogale gracilis saxatilis Merriam

Little Spotted Skunk

From west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; and Kleckner Creek, 4 miles east of Lee. Six specimens.

Reports of local trappers and our own experience showed that spotted skunks were rare in the Ruby Mountains. We trapped for them at each of our camps but took specimens only at our camp site on the west side of Ruby Lake. Here, between December 22 and 30, 1927, four specimens were captured on ledges of the rimrock in a dry canyon at about 7000 feet altitude. Two other specimens were received from Mr. C. H. Kleckner, who caught them on Kleckner Creek, four miles east of Lee.

Mephitis mephitis major (Howell)

Striped Skunk

Although we trapped in apparently favorable places, no specimens of the striped skunk were obtained by members of our party. We were fortunate in obtaining from Mr. C. H. Kleckner three males in prime winter pelage. They were trapped on Kleckner Creek, four miles east of Lee, at about 6500 feet altitude. Here the canyon widens out and there was considerable water which supported a good growth of trees, brush, and herbaceous vegetation.

In each of our three specimens there is a cross band of white near the tip of the tail and in two of them the white stripes extend all the way down the sides of the tail. The tail length averages 40 per cent of the total length. This percentage is less than in the average of topotypes of *major* (see Howell, 1901, pp. 24, 27), but more than in specimens of *hudsonica*, the race found next adjacent to the northward. Only one of our specimens has the widely expanded zygomata which are thought to characterize *major*. Our specimens appear to be about as near to *hudsonica* as to *major*, but on geographic grounds we have placed them with *major*. For use of the specific name *mephitis*, see Hall (1931, p. 1).

Pertinent measurements in millimeters are as follows: First, adult male (no. 6061); second, subadult male (no. 9055); third, young male (no. 9056): Total length, respectively, 675, 710, 730; tail, 270, 280, 300; hind foot, 82, 80, 80; basal length of skull, 70.7, 71.2, 72.7; zygomatic breadth, 50, 48.6, 49.4; breadth across postorbital processes, 23.1, 22, 22.7; least interorbital breadth, 22.5, 21.8, 22.1; palatal length, 29.9, 31.2, 32.4.

Taxidea taxus taxus (Schreber)

Badger

From west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Kleckner Creek; and Summit of Secret Pass. Four specimens.

Badgers were found throughout our area below 7000 feet altitude, but at no place were they common. Residents trap them for their fur and destroy them because their large burrows are regarded as dangerous to horses and their riders.

One badger found in an open meadow was easily captured. It was extremely emaciated, evidently because it was incapacitated by the loss of the two center claws of the left fore foot, probably from being caught in a steel trap. Obviously the toes had been missing for several weeks, as the foot was entirely healed. Since the badger was hampered in its digging the claws on the other fore foot had grown one-third beyond their normal length.

At four o'clock one afternoon a large badger, apparently unaware of the observer, was watched for fifteen minutes as it foraged in a newly-mown alfalfa field. It would trot quickly ten or fifteen feet in one direction and then stop abruptly and, standing or squatting on its haunches, sniff the air in various directions. Each time it repeated the maneuver, it traveled at an angle to the direction just taken and so made a zigzag trail across the field. When trotting it held its nose close to the ground, but when standing or squatting it sometimes raised its nose upward to the full extent of its short neck. When disturbed it ran a short distance and took refuge in a burrow which had recently been excavated. During the last two weeks of December, 1927, although the ground was frozen and the nightly temperatures were about 0°F., fresh badger diggings were observed in a meadow on the edge of Ruby Lake.

On several occasions we saw evidence that badgers had dug out and eaten ground squirrels (*Citellus elegans*). In our area these squirrels probably furnish a large portion of the food of badgers, since badger workings most often were seen where ground squirrels were numerous.

One female taken March 16, 1929, on Kleckner Creek, 6500 feet, contained three large embryos. Another taken March 28, 1929, near the same place, showed clearly that it had recently borne young. Each had four pairs of mammae.

The two females taken in March still are in winter pelage, but the guard hairs show some wear. They are noticeably lighter in color than the two summer specimens.

Canis latrans lestes Merriam

Coyote

From west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Kleckner Creek; and Steels Creek. Nine specimens.

In spite of persistent persecution, coyotes occur commonly throughout the Ruby Mountains. They either were seen or heard, or their tracks were found, about each of our camp sites.

Coyotes forage through almost every habitat and utilize a great variety of food. On several occasions they were seen foraging about the tules and meadows at the edge of Ruby Lake, where meadow mice were numerous. An adult female that was shot late in the afternoon of June 6, 1928, as it trotted across a sage-covered flat, had in its stomach a number of cicadas and several grasshoppers. During December, when the ground was covered with snow, a pair of coyotes came nightly to feed on the much dried carcass of a cow.

On June 16, 1929, at about 7500 feet altitude on Steels Creek, a large burrow was found beneath a ledge of rock. From this burrow four young coyotes were trapped on

four successive days. The pups were old enough to stray a short distance from the burrow, as shown by the presence of diggings and small foot marks in the vicinity. The female was never seen. The burrow was located on a steep south-facing slope which supported a good stand of *Ceanothus*, chokecherry, and some mountain mahogany.

Coyotes were more in evidence about our camp on the head of Ackler Creek than at any other locality. Here, one or more coyotes were seen or heard every day during our stay of eight days. On one occasion an adult and two half-grown pups were seen on top of a high rocky ridge that was the home of a colony of marmots. A few days later, an adult and two young were observed in a dense stand of aspen near the same place. The mother and the pups were chasing each other back and forth through the trees, yelping, tumbling, and playing like domestic dogs. They dashed into a thicket when the mother spied the observer who was standing within fifty feet of her.

An adult male and female taken on February 5 and April 10, respectively, already had lost practically all of their guard hair. Another adult male taken March 30 still was in good winter pelage; it showed little or no loss of guard hair.

Felis concolor hippolestes Merriam

Mountain Lion

None of our party found any evidence of the presence of mountain lions in the Ruby Mountains. However, there is good evidence that lions were in this range recently. Mr. August Rohwer writes that he saw the tracks of two in the north end of the range in 1928. He reports also that an Indian killed a female and captured five young ones on Thompson Creek in 1922. Mr. William Toyn writes that he saw the tracks of one in the north end of the range in 1928, that Charles Hairgrove killed two mountain lions on the South Fork of the Humboldt River in 1912, and that some time later John Peters killed one near Huntington in the southern end of the range.

Lynx rufus pallescens Merriam

Bobcat

From Willow Creek; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; and Kleckner Creek. Nine specimens.

Fur trappers catch bobcats in limited numbers throughout the Ruby Mountains. The locality records of nine specimens taken during our survey indicate that bobcats were most numerous in canyons which were bordered with rimrock and that supported a good growth of pinyon, juniper, mountain mahogany, *Ceanothus*, and other brush. Woodrats, cottontails, chipmunks, and several species of mice were numerous in this habitat and probably attracted bobcats to these places. One large cat was caught three feet within the entrance of a small cave in a trap baited with a woodrat.

The bobcats that we secured are large and light-colored. One female trapped December 20, 1927, near Hobson weighed twenty pounds.

Marmota flaviventris avara (Bangs)

Yellow-footed Marmot

From Long Creek and head of Ackler Creek. Sixteen specimens.

Marmots were found at the higher altitudes throughout the Ruby Mountains. They were most numerous in the northern part of the range and above 8000 feet, especially in the vicinity of Three Lakes at altitudes between 9700 and 11,000 feet. A number were observed at the head of Ackler Creek at 9000 feet, at the same altitude at the head of Steels Creek, and in Long Creek Canyon. Occasionally an individual strayed down into

lower altitudes; one was seen at 7000 feet in Willow Creek Canyon in the south end of the Ruby Mountains, and another, not listed above, was shot at 6300 feet altitude on the east base of the range, 10 miles south of Secret Pass. The latter, an immature female, was quite out of its usual environment. It was shot as it ran into a burrow in a low bank at the edge of a meadow, near which there were no rocky retreats. A few marmots were known to inhabit Pole Canyon at about 7000 feet altitude.

The favorite home site of marmots in the Ruby Mountains is an isolated group of large boulders surrounded by vegetation. Here they live in burrows beneath the rocks, but spend much of their time basking in the sun on top of the boulders, which also serve as look-out posts. When an approaching enemy is sighted they often sit up on their haunches and utter clear loud chirps or barks. Generally, the presence of marmots was easily detected by the accumulations of droppings upon the look-out rocks. The boulders used as marmot homes when situated near streams, usually were surrounded by aspen and chokecherry and a herbaceous undergrowth. The rockpiles on hillsides which were used by marmots were surrounded by sagebrush, *Ceanothus*, wild rose, service berry, antelope-brush, and occasionally limber pine.

In the Ruby Mountains marmots often have to travel considerable distances to procure food. Fresh tracks found on July 13, 1928, showed where a large marmot had travelled thirty yards across a patch of snow which covered part of a rockslide. The tracks of the hind feet were three inches long and resembled tracks of a small raccoon. None of the trees or other woody plants growing about marmot dens showed any signs of having been gnawed by these rodents.

Young from one-fourth to one-half grown were observed several times during the month of July, 1928 and 1929, at about 9000 feet altitude. Large boulders sometimes were the homes of family groups. On five occasions during the month of July, 1929, two parents with their young, from two to four in number, were seen together on top of a large boulder. In a number of other cases a pair of adults were seen daily upon certain rocks. This would indicate that breeding pairs remain together while raising their families and possibly throughout the year. Study of our specimens indicates that by the end of July most of the adults have completed the annual moult and are in the winter pelage.

On July 2, 1929, a colony of marmots was found among some rocky ledges at the head of Ackler Creek. On this date twelve marmots were seen and others were heard. As this colony was visited on successive days the numbers seen or heard became noticeably fewer, and on July 7 none was heard and only two were seen. This scarcity and quietness may have been due to the disturbance caused by our daily visits, but we suspected that it was because the marmots were beginning to hibernate.

Golden eagles and coyotes were seen several times about marmot colonies and probably they are among the marmot's most dangerous enemies.

Our series of marmots does not entirely agree with the description of any known form (Howell, North Amer. Fauna, No. 37, 1915) or with topotypes of the forms whose ranges surround the Ruby Mountains. Study of fifteen skins (3 old adults, 4 young adults, 8 juveniles) and the skulls of two other old specimens, all taken in July, shows that the Ruby Mountains population is characterized by large size, dark colored upper parts, very light under parts, and a large, angular skull flattened dorsally and having a heavy rostrum. Comparison with topotypes of *Marmota flaviventris flaviventris*, *sierrae*, *fortirostris*, *parvula*, *engelhardti*, *nosophora* and *avara*, and with the published descriptions of these, indicates that the Ruby Mountains population is most nearly like *avara*. Our specimens are neither *engelhardti* nor *nosophora*, as both of these forms are much darker (redder) beneath and lighter above. *M. f. flaviventris* is decidedly darker beneath and on the sides and flanks. *M. f. sierrae* is noticeably darker beneath and is

lighter and more cinnamon above than the Ruby Mountains series. *M. f. fortirostris* is about the same color beneath, but is decidedly lighter above, being light cinnamon rather than chestnut brown. As compared with *parvula*, our specimens are much larger in every part measured, are darker above, are lighter below, and have heavier rostra. Unfortunately, the four available specimens of *parvula* are not adult. Indeed, it seems probable that none of the existing museum specimens of *parvula* is fully adult. Thus its seeming small size and the other characteristics that distinguish it from the Ruby Mountains animal may, with better material of *parvula*, prove to be nonexistant. If *parvula* proves to be a large animal with a heavy rostrum, our specimens might be identified with it since the color differences are slight. Our specimens differ from *M. f. avara* in that they are a little larger, both in external and cranial measurements, are considerably darker above, especially over the shoulders, and have skulls which are flatter dorsally and have slightly heavier rostra.

TABLE 1

Measurements, in millimeters, of adult Marmota flaviventris avara from Ruby Mountains, Nevada

CATALOGUE NUMBER	LOCALITY	SEX	TOTAL LENGTH	LENGTH OF TAIL	LENGTH OF HIND FOOT	CONDYLOBASAL LENGTH	PALATAL LENGTH	POSTPALATAL LENGTH	LENGTH OF NASALS	ZYGOMATIC BREADTH	MASTOID BREADTH	LEAST INTERORBITAL BREADTH	BREADTH OF ROSTRUM	ALVEOLAR LENGTH OF UPPER MOLAR SERIES
5442	Long Creek, 8000 ft	♂	640	180	78.0	90.0	50.2	35.0	39.0	57.6	41.6	18.1	21.5	19.1
6287	Head of Ackler Creek, 7800 ft	♂	650	165	83.0	88.7	52.5	36.0	38.9	62.4	44.4	22.6	21.8	19.6
6281	Head of Ackler Creek, 7800 ft	♂	640	168	78.0	91.5	51.0	36.6	40.7	63.6	43.8	22.2	22.6	20.6
	Average		643	171	79.6	90.0	51.2	35.8	39.5	61.2	43.2	20.9	21.9	19.7
6288	Head of Ackler Creek, 7800 ft	♀	530	145	74.0	75.2	41.7	29.5	29.7	52.0	36.0	17.0	18.0	19.4
5443	Long Creek, 8000 ft	♀	560	160	71.0	80.2	45.3	31.4	33.3	54.1	37.3	17.9	19.8	19.6
6277	Head of Ackler Creek, 7800 ft	♀	515	130	70.0	76.9	42.4	30.6	31.1	49.9	36.4	16.2	17.3	18.6
	Average		535	145	71.6	77.4	43.1	30.5	31.3	52.0	36.5	17.0	18.3	19.2

Callospermophilus chrysodeirus trepidus Taylor

Golden-mantled Ground Squirrel

From Willow Creek; Overland Pass; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Three Lakes; Jerry Creek; Steels Creek; and head of Ackler Creek. Twenty-seven specimens.

Golden-mantled ground squirrels were found throughout the Ruby Mountains. Although recorded at altitudes as low as 6000 feet, these squirrels were much more numerous above 8500 feet. They were more common about our camp at Three Lakes, 9700 feet altitude, than at any other camp site. Rock-slides and open stands of timber where there was an abundance of boulders and fallen logs proved to be the favorite haunts of these squirrels. They were seen often on the tops of logs, rocks, and stumps, but they were not observed to climb trees. When foraging they sometimes traveled long distances from their homes and were then found in a number of different habitats.

On June 4, 1928, at 6200 feet altitude, incessant squeaking attracted our attention to three young of this species in a small thicket. The animals were so small as to suggest

that they were on their first venture away from home. A specimen about one-third grown was taken at Three Lakes on August 10, 1928. This may indicate either a long breeding season, or merely later breeding at the higher levels.

These squirrels were observed to gather pinyon nuts and the fruit of a wild currant; also they came into camp to hunt for scraps, being especially eager for bits of bacon. When a chipmunk was placed in the same cage with two golden-mantled ground squirrels it was killed and almost entirely eaten within a few hours.

During our stay from October 12 until November 6, 1929, no individual of this species was seen, indicating that all had gone into hibernation by that time.

A series of twenty-seven specimens cannot be distinguished from a series of *C. c. trepidus* from the Pine Forest Mountains, Nevada.

Citellus elegans nevadensis Howell

Nevada Ground Squirrel

From west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Three Lakes; Summit of Secret Pass; Jerry Creek; and Steels Creek. Seventeen specimens.

This ground squirrel occupies a wide range of altitudes and several types of habitat. With the exception of *Peromyscus maniculatus*, it was the most numerous and widely distributed mammal found within our area. Although more abundant at lower altitudes, it was recorded from as high as 10,000 feet. This squirrel was found on rock slides, in aspen thickets, and on sagebrush flats, but it showed a decided preference for meadows and other areas covered with herbaceous vegetation. It was numerous also in grain and alfalfa fields and about gardens. In favorable areas it was possible to see from ten to twenty ground squirrels at one time. When abundant it does considerable damage, especially to garden crops.

The following record gives some idea of the abundance of these squirrels in Elko County. During the summer of 1928, the sportsmen of Elko County sponsored a campaign against the so-called vermin. Mr. George M. Green, of Elko, scorekeeper during the contest, reports squirrel tails counted and recorded by months as follows: March, 450; April, 1279; May, 13,110; June, 13,879; July, 1046; August, 5667.

These squirrels were still active in late August. We were not in the field during September, but we were in the area for several weeks beginning October 5, 1929, on or after which date none was seen. Many young individuals of various sizes were seen throughout June, July and the early part of August.

Remains of three ground squirrels of this species were found in the crops of Swainson hawks, and the remains of another in the crop of a prairie falcon.

This species previously has been recorded from our section by Howell (1928, p. 212), who mentions specimens from Skelton and Ruby Valley.

Eutamias minimus pictus (Allen)

Sagebrush Chipmunk

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Three Lakes; Summit of Secret Pass; Jerry Creek; Steels Creek; and head of Ackler Creek. Twenty-five specimens.

These chipmunks were common in sagebrush habitats throughout the Ruby Mountains. Their distribution was limited only by the absence of sagebrush. Since this plant was found commonly in our territory from the flats at 6000 feet altitude to the ridges above 10,000 feet, these chipmunks had an extensive distribution.

Sagebrush chipmunks usually were seen running on the ground among the sage, but occasionally they were observed climbing about in the sagebrush, or other low bushes. When the animals run for shelter the long tail is especially noticeable, since it then is carried almost perpendicular to the body.

This species usually makes its home in burrows in the ground, but near our camp at Jerry Creek, on June 27, 1929, a nest was found on a flat beam six feet from the floor in a deserted cabin. The nest was composed of cotton, taken from an old mattress, and was the home of three young which were about three-fourths grown. On several successive evenings these young were observed to return to this nest.

During a two weeks stay in the south end of the Ruby Mountains, in the latter part of December, 1927, none of these chipmunks were seen. However, they were active during the month of October, 1929, at the same place.

From our area two specimens previously have been recorded by Howell (1929, p. 40) as taken in the "Ruby Mountains."

Eutamias quadrivittatus inyoensis Merriam

Inyo Chipmunk

From Willow Creek; Overland Pass; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; west side of Ruby Lake, Elko County, 6 miles north of the White Pine County line; Harrison Pass Ranger Station; Kleckner Creek; Three Lakes; Steels Creek; and head of Ackler Creek. Forty-three specimens.

Inyo chipmunks were widely distributed throughout the Ruby Mountains. They were less restricted by habitat requirements than were the sagebrush chipmunks. However, they seemed to prefer living in or about the conifers—pinyon, juniper, and limber pine. They were seen also among mountain mahogany and service berry, occasionally in stands of aspen or willow, in rock slides, or about rocky canyons. Within our territory the junipers grow at altitudes as low as 6000 feet and the limber pine may be found as high as 11,000 feet. These chipmunks were recorded from one of these altitudinal extremes to the other. They were primarily terrestrial, but occasionally we saw them in trees.

Most of the chipmunks of this species in the Ruby Mountains hibernate, or at least remain under cover, during the winter. However, a few were active during winter months. On December 23, 1927, two individuals were collected at 7000 feet altitude as they were running about the trunk of a juniper tree. A few days later another was seen sunning itself on top of a rock a short distance from where the first two were taken. At this time there was a foot of snow on the ground and the temperature at night was around 0°F., although the days were sunny and relatively warm. Where available, the pinyon nuts furnished a large part of the food for this species.

Specimens taken in October, 1929, are in full winter pelage, which is duller in color than the summer coat.

When A. H. Howell revised the American chipmunks he recorded (1929, p. 86) twenty-six specimens of this race from the "Ruby Mountains."

Thomomys quadratus fisheri Merriam

Fisher Pocket Gopher

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Three Lakes; Summit

of Secret Pass; Jerry Creek; Steels Creek; and head of Ackler Creek. Sixty-two specimens.

This was the only pocket gopher found within our territory. It was widely distributed, seemingly with little regard for altitude, kind of soil, or type of vegetation. Gophers were trapped, or their workings were found, in almost every habitat. They were present in the meadows, in wet creek bottoms, among sagebrush, aspen, juniper, and pinyon, and also on the high rocky ridges.

On July 12, 1928, at Long Creek, we found a gopher at work in an aspen grove. It was extremely active on several successive days, especially in the mornings. It dug to the surface in a number of places and gathered several varieties of herbs and some grass. The stems were cut off just above the ground and the leaves dragged down into the burrow. The gopher worked rapidly, taking most of the small vegetation which it could reach without getting its tail and hind feet away from the mouth of the burrow. Later we learned that this was a female gathering food for a litter of half-grown young.

When young gophers are about half-grown they emigrate from the home burrow. This is shown by the fact that several specimens of this size were caught in mouse traps set on top of the ground, and also by the finding on three occasions of young gophers in the road at night. The young evidently are born early in the summer; fifteen adult females taken in June and July contained no embryos, and a number of half-grown young were taken during these two months. On July 12 and 13, 1928, four half-grown young and an adult female were trapped in the same burrow.

Several gophers taken during the latter part of October, at 6000 feet altitude, had almost completed the fall moult; they are lighter colored than those in the summer coat.

Nine topotypes of *Thomomys quadratus uinta* were compared with eight topotypes of *Thomomys quadratus fisheri* and other specimens referred to *fisheri* from Alpine, Churchhill County, Nevada. Characters found constantly to differentiate *uinta* from *fisheri* are as follows: nasals posteriorly deeply emarginate, rather than truncate; nasals broader anteriorly; color above, duller and darker brown. As regards each of these characters our specimens agree with *fisheri*. Other features, in which *uinta*, on the average, differs from *fisheri* are: rostra heavier; bullae smaller; incisors larger and more projecting; top of skull more flattened; lacrimal processes more prominent; temporal ridges bowed in rather than parallel or convex laterally. On the basis of these last mentioned characters our specimens are intermediate between *uinta* and *fisheri*.

Specimens from the northern parts of the Ruby Mountains and from the higher elevations, are usually larger, darker, and have heavier rostra and incisors than do those from the lower elevations and the southern end of the mountain range. In these respects the more northern-taken specimens show slight approach to *uinta* but do not, we think, demonstrate complete intergradation between the two races *uinta* and *fisheri*.

Bailey (1915, p. 116) has recorded five specimens of this race from our area. Three were from Ruby Lake and two from the "Ruby Mountains."

Perognathus parvus olivaceus Merriam

Great Basin Pocket Mouse

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Summit of Secret Pass; Jerry Creek; Steels Creek; and head of Ackler Creek. Seventy-three specimens.

These mice were recorded from suitable habitats throughout the lower altitudes of the entire region. A few were trapped at 7800 feet, but the great majority were taken below 7000 feet.

Low hills, flats, and canyon bottoms overgrown with heavy stands of sagebrush, service berry, antelope brush, rye grass, and other herbs and grasses were the preferred habitats. In these places the soil usually was of a humus or sandy nature. Several specimens were trapped among grass or trees on steep slopes, and a few were taken in traps set for *Peromyscus truei* and *Peromyscus crinitus* along the sides of steep rocky canyons where vegetation was sparse. Although pocket mice were active above ground during the month of October, but few were caught on the coldest nights.

Four pregnant females were trapped between June 15 and June 28. Two of these contained five embryos each; the other two had six embryos each.

The stomach of a long-eared owl contained the remains of four individuals of this species.

Dipodomys ordii columbianus (Merriam)

Columbian Kangaroo Rat

From west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; and Jerry Creek. Eighteen specimens.

Certain limited areas about Jerry Creek and along the east base of the range were somewhat sandy, and here small colonies of this species were located. The largest colony found was inhabiting an uncultivated rye patch about our Jerry Creek camp. Those taken were among rabbit-brush, sagebrush, and rye grass.

A female trapped on August 7, 1927, contained two embryos; another obtained the following day contained four embryos. Four half-grown young were captured between June 24 and 27, 1929. Specimens taken between August 4 and 9, 1927, are in worn pelage; those caught between October 27 and November 4, 1929, are in new winter pelage.

Castor canadensis baileyi Nelson

Humboldt River Beaver

Beavers are found in limited numbers along the main branches of the Humboldt River, but have been almost completely exterminated along the smaller streams which flow out of the Ruby Mountains. Mr. August Rohwer and Mr. William Toyn reported that there were still a few beaver in one or two of the canyons on the west slope of the Ruby Mountains. Characteristic beaver gnawings found by us on some partly decayed aspen stumps at about 7000 feet altitude along Toyn Creek, near the summit of Harrison Pass, indicated the former presence of beaver there (see pl. 3).

Onychomys leucogaster brevicaudus Merriam

Short-tailed Grasshopper Mouse

Only three grasshopper mice were taken; one juvenile among sagebrush near the summit of Secret Pass on July 12, 1927, and two adults at Hobson in October, 1929. One of the adults was trapped among rabbit-brush and the other on the dirt floor of a deserted cabin.

Reithrodontomys megalotis megalotis (Baird)

Desert Harvest Mouse

Ten harvest mice taken in October and November, 1929, near Hobson, west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line, represent our entire catch of this species. Nine of them were trapped among rabbit-brush and sage-

willow, aspen, and chokecherry, with an undergrowth of nettle, aconite, blue-bell, and wild rose. The nest was ten feet above the ground, but in order to reach it the wood rat had to climb for a distance of twenty feet along sloping branches. The bulk of the nest, which was three feet in diameter at the base and two feet high, was composed of short, dry sticks with pieces of freshly cut chokecherry, blue-bell, and nettle scattered over the top. Within the nest-pile there was a cavity twelve inches in diameter in which the nest proper was located. It had an inside diameter of six inches and was entirely composed of dry fibres of willow bark. Two hundred yards away was another large nest, three feet high, built on the wet ground at the edge of the creek among small willow trees.

On May 31, 1929, three young, their eyes still closed, measuring respectively, 184, 185, and 195 millimeters in total length, were taken from the nest described above as situated in the willow tree. The color of these young varies from light to dark grayish buff. A number of other young from one-third to two-thirds grown were taken during June, July and August. This series shows that the half-grown young are buffy gray and that they become more buffy as they grow older. The winter pelage is like the summer pelage in color, but is longer, softer, and more dense. None of our specimens shows definite molting lines. We take this to indicate that molt is more or less uniform over the whole body.

The remains of a wood rat were found in the crop of a red-tailed hawk.

As compared with specimens of *Neotoma cinerea occidentalis* from Modoc County, California, the series from the Ruby Mountains is much lighter in color and shows no appreciable approach in characters to that form.

One very old male is much larger than any other of our series; indeed it furnishes the maximum for each of the measurements given below. Also, it is the lightest in color. The basilar length of the skull of this specimen is greater in proportion to the zygomatic breadth than in any other specimen measured. According to Allen (1894, p. 236), this proportion usually increases with advancing age. Among the adults, the males average larger than the females, but otherwise they are quite uniform in skull measurements and color.

Average and extreme measurements in millimeters of 6 adult male *Neotoma cinerea cinerea* from the Ruby Mountains are as follows: Total length, 412.0 (500–343); tail, 182.0 (212–145); hind foot, 43.5 (50–35); basilar length of Hensel, 46.3 (52.1–40.6); zygomatic breadth, 28.4 (31.7–26.0); interorbital breadth, 6.0 (6.6–5.6); nasals, 21.2 (23.9–19.2); incisive foramina, 12.0 (13.0–10.4); length of palatal bridge, 9.3 (10.4–8.8); alveolar length of upper molar series, 10.7 (11.1–10.1).

Microtus montanus montanus (Peale)

Peale Meadow Mouse

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Three Lakes; Steels Creek; and head of Ackler Creek. Forty-one specimens.

This species is widely distributed throughout the Ruby Mountains. At most of our camps both *Microtus montanus* and *Microtus mordax* were taken, but each was restricted by habitat requirements so that both species seldom were caught in exactly the same location. Most of the tule swamps, bogs, and springs where the water was standing or running slowly, and where there was a heavy growth of grass and herbs, harbored *Microtus montanus*. In such places we usually could find its trails cut through the grass or leading across soft mud and sometimes through shallow water. Droppings and bits of

cut grass were generally found along these trails. Habitats favored by this species usually were occupied also by *Sorex vagrans*. In summer, these mice were never captured more than a few feet from water.

Several individuals of this species were trapped during the latter part of December. At this time their tunnels were found beneath three feet of snow and in some cases these tunnels led over areas which were too dry and open during the summer to be occupied by this species. On December 15, 1927, attention was attracted to an animal that was moving along beneath the snow and raising it to form a ridge or windrow, much as a mole does in soft ground. A quick grab into the moving snow, which was two inches deep and slightly crusted, produced an adult female *Microtus montanus*. The ability of these mice to make tunnels beneath the snow enables them to forage above ground during the winter. We found that other mammals, such as *Sorex vagrans* and *Peromyscus maniculatus*, made use of *Microtus* tunnels beneath the snow.

TABLE 2

Measurements in millimeters of the eight individuals, among the series of 41 specimens of Microtus montanus montanus, which have the largest skulls

CATALOGUE NUMBER	SEX	LOCALITY	TOTAL LENGTH	LENGTH OF TAIL	LENGTH OF HIND FOOT	CONDYLOBASAL LENGTH	LENGTH OF NASALS	ZYGOMATIC BREADTH	INTERPARIETAL BREADTH	HEIGHT OF CRANIUM AND BULLAE	MASTOID BREADTH	ALVEOLAR LENGTH OF UPPER MOLAR SERIES
44503	♂*	Willow Creek	180	48	20	30.0	8.8	16.9	7.9	10.0	13.6	7.3
6473	♂	Willow Creek	172	45	21	28.1	7.5	15.6	7.9	9.9	12.5	6.8
4663	♂	West side Ruby Lake	161	40	20	29.7	8.1	16.2	8.8	10.4	12.8	6.8
4423	♂	West side Ruby Lake	185	47	21	30.3	8.0	17.1	8.1	10.4	13.3	7.2
4425	♂	West side Ruby Lake	165	42	21	29.7	8.2	17.0	8.6			7.0
5601	♀	Three Lakes	187	50	20	29.1	7.7	16.5	8.2	10.1		6.9
5595	♀	Three Lakes	182	42	20	29.2	7.9	16.9	8.5	10.3	13.2	6.8
5589	♂	Three Lakes	184	47	21	29.0	7.9	16.8				6.9
Average			183	45	20.5	29.4	8.0	16.5	8.2	10.2	13.1	6.9

* M. V. Z.

A female taken on August 12, 1928, at 9700 feet, contained 6 embryos.

Bailey (1900, p. 28) recorded five specimens of *Microtus m. montanus* from "Ruby Lake" and five from the "Ruby Mountains."

Microtus mordax mordax (Merriam)

Cantankerous Meadow Mouse

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Three Lakes; Summit of Secret Pass; Steels Creek; and head of Ackler Creek. Seventy-one specimens.

This species was recorded from one end of the range to the other and from 6000 to 10,000 feet altitude. Although somewhat restricted by habitat requirements, it was

much more widely distributed in our territory than was *Microtus montanus*. The presence of water did not seem to be essential to the existence of *Microtus mordax*, as individuals were trapped commonly among sagebrush as much as half a mile from water. The banks of streams, where there was grass or brush, usually were occupied by this species. It inhabited also meadows, hillsides covered with chaparral or grass, willow thickets, and rock slides. Like *Microtus montanus*, this species also made trails when living in meadows or grass, but when living in sagebrush or chaparral there was usually little or no visible evidence of its presence. Sometimes specimens of *Microtus mordax* were taken in the same traps which caught *Lagurus*.

Five females taken between June 15 and July 11 contained the following numbers of embryos: 4, 4, 5, 5, 6.

The remains of two *Microtus*, apparently of this species, were found in the crop of a Swainson hawk.

Comparison of topotypes of *Microtus mordax latus* from the Toyabe Mountains with four topotypes of *Microtus m. mordax* and thirty other specimens from the Seven Devils

TABLE 3

Average and extreme measurements in millimeters of ten adult male and ten adult female Microtus mordax mordax taken between Harrison Pass and Secret Pass

	TOTAL LENGTH	LENGTH OF TAIL	LENGTH OF HIND FOOT	CONDYLOBASAL LENGTH	LENGTH OF NASALS	ZYGOMATIC BREADTH	INTERPARIETAL BREADTH	HEIGHT OF CRANIUM	MASTOID BREADTH	ALVEOLAR LENGTH OF UPPER MOLAR SERIES
Average	187	64	21.2	27.6	8.0	14.9	8.6	10.0	12.7	6.6
Minimum	174	57	20.0	26.7	7.7	14.5	7.8	9.7	12.0	6.3
Maximum	196	68	22.0	29.0	8.4	15.2	9.1	10.2	13.3	6.9
Average	185	63	20.9	28.9	7.6	14.9	8.7	10.0	12.3	6.6
Minimum	171	57	20.0	26.2	7.1	14.1	8.1	9.6	11.8	6.4
Maximum	197	70	22.0	28.7	8.6	16.2	9.1	10.2	13.6	6.8

Mountains, Idaho (assumedly representing the subspecies *mordax*), reveals that the skull of *latus* is wider and generally larger, with greater vertical depth through the preorbital region. As regards these differences, our Ruby Mountains animals (using specimens taken between Harrison Pass and Secret Pass) have the skulls even deeper through the preorbital region at the junction of the frontals and nasals than in *latus*, though the distal end of the rostrum does not turn down so abruptly. However, the skulls of our specimens are narrower than those of *latus*, especially in the zygomatic and mastoid breadths, in which respects they resemble *mordax*. In color our specimens are intermediate between *latus* and *mordax* but seem to be nearer the latter. In the aggregate of characters considered, specimens from the Ruby Mountains are intermediate between those of *mordax* from the Seven Devils Mountains, and those of *latus* from the Toyabe Mountains, but seem better referred to *mordax*.

Bailey (1900, p. 50) recorded fourteen specimens of *Microtus mordax mordax* from the "Ruby Mountains."

Lagurus curtatus intermedius Taylor

Sagebrush Vole

From Willow Creek; Overland Pass; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; Harrison Pass Ranger Station; Long Creek; Three Lakes; and Summit of Secret Pass. Thirty-one specimens.

These voles were nowhere abundant, but were found in small colonies in several different sections of the Ruby Mountains, from 6000 to 10,000 feet altitude. We found them to be most numerous in Green Mountain Canyon (locality no. 4) at about 7000 feet (see pl. 4). Here they were living on a steep, comparatively moist slope which was covered with sagebrush, service berry, and rye grass. At about 7000 feet altitude on Willow Creek, they were living in a small area on a steep slope which was covered by

TABLE 4

Average and extreme measurements in millimeters of three forms of Lagurus

	TOTAL LENGTH	LENGTH OF TAIL	LENGTH OF HIND FOOT	BASILAR LENGTH OF HENSEL	LENGTH OF NASALS	ZYGOMATIC BREADTH	MASTOID BREADTH	ALVEOLAR LENGTH OF UPPER MOLAR SERIES	HEIGHT OF CRANIUM AT BULLAE	GREATEST LENGTH OF SKULL
12 adults from the Ruby Mountains	121.7 (142–109)	20.8 (26–15)	16.5 (18–15)	21.0 (21.9–19.9)	6.5 (7–6.1)	13.5 (14.3–13)	11.8 (12.5–11.3)	5.6 (6.1–5)	8.7 (9–8.4)	23.4 (24.6–21.9)
10 adult near-topotypes of *curtatus*[1]	130.0 (135–127)	21.4 (25–20)	17.2 (18–15)	21.4 (21.9–20.6)	6.6 (7.1–6.3)	14.1 (14.5–13.4)	12.0 (12.4–11.5)	5.7 (5.9–5.4)	9.0 (9.5–8.6)	24.1 (24.8–23.3)
5 adult specimens of *pauperrimus*[2]	121.0 (125–120)	22.0 (27–21)	16.9 (17.5–16)	20.2 (20.8–19.7)	6.3 (6.8–5.8)	13.6 (13.9–13.0)	11.6 (12–11.3)	5.4 (5.5–5.4)	8.3 (8.8–8.0)	22.9 (23.5–22.4)

[1] From Chiatovich Creek, 8200 feet, Esmeralda County, Nevada.

[2] One from Cedar Mountains, Malheur County, Oregon; two from Lily, Moffat County; and two from Toponas, Routt County, Colorado.

heavy sagebrush. Above Three Lakes at 10,000 feet altitude, several *Lagurus* were trapped on a dry ridge covered with short, densely growing sagebrush.

Several specimens of this vole were trapped in widely separated locations; a few were taken in traps set for shrews along the edges of creeks, and one among rocks twenty-five yards from the nearest sagebrush. All individuals taken at a distance from colonies, or in unusual environments, such as in willow thickets at the water's edge, or among the rocks, proved to be immature. The burrows were located beneath the stumps of large sage bushes, and occasionally trails led out from these.

Sagebrush voles were found to be not entirely nocturnal, as several were trapped during the daytime. They were active under the snow, as was shown by the accumulations of sagebrush bark, twigs and leaves, and the droppings of the animals, all of which were found under heavy sagebrush after the snow had melted.

A number of young voles from one-half to three-fourths grown were taken between the first of June and the last of July. One female trapped on May 30 contained five embryos; another taken on June 15 contained three embryos.

The thirty skins of *Lagurus* from the Ruby Mountains show considerable variation in color. Some individuals are light buffy brown, and others are light gray. This grayness in some specimens is due to wear. As the brownish tips of the hair are worn away the lower portion of the hair, which is deep bluish gray, is exposed. The young are more grayish in color than the adults.

Compared with a large series of near-topotypes of *Lagurus curtatus curtatus*, the Ruby Mountains specimens are smaller in total length and hind-foot measurements, and they are slightly more brownish. Our specimens have slightly smaller, lighter and less angular skulls, with smaller bullae. The parietal ridges are less prominent than are those of *curtatus*. All of these differences are those which separate the form *Lagurus pauperrimus* from *L. curtatus* (see table on p. 35); however, none of these differential features in our specimens is so prominent as in typical specimens of *pauperrimus*. Our series possesses characters intermediate between the characters of the forms *curtatus* and *pauperrimus*, but does not show complete intergradation between the two.

The systematic status of the form *Lagurus intermedius* is not well established, since the material used in the original description (Taylor, 1911, pp. 253–258) is meager and shows a wide range of variation. Our examination of the type and five paratypes upon which the name *intermedius* was based shows that only three of these are fully adult; and one of the adults has a broken skull. However, these specimens do show characters intermediate between those of *curtatus* and *pauperrimus*, and are very close to our specimens both in external and cranial characters. In our opinion, *Lagurus intermedius* does not deserve full specific standing, but instead should be treated as a subspecies of *Lagurus curtatus*.

Ondatra zibethica mergens (Hollister)

Nevada Muskrat

From west side of Ruby Lake, Elko County, 3 miles north of White Pine County line; west side of Ruby Lake, Elko County, 6 miles north of the White Pine County line; and Three Lakes. Twenty-seven specimens.

Ruby Lake presents conditions ideal for habitation by muskrats. Since the lake is in reality a large tule marsh, interspersed by numerous areas of open water, the conditions existing in the middle of the lake are as favorable to muskrats as were those along the shore. Muskrats were quite numerous over the entire marsh but were being rapidly reduced by intensive trapping. During the first part of August, 1928, two or three pairs of muskrats were inhabiting Favre Lake at an altitude of 9600 feet, which is the lowest one of Three Lakes. At Favre Lake the muskrats lived entirely in holes in the bank; there were no houses on the lake. Muskrat trails ran back from the edge of the lake through tall grass into the willow thickets, where gnawed limbs and cut twigs of willow saplings were found. There was little growing vegetation in the lake.

At Ruby Lake, muskrats lived in holes in the banks and also in houses which were located among the tules in shallow water, rather than out in the open water. One occupied house examined on May 23, 1928, was five feet in diameter at the base and four feet high. It was composed entirely of dead tules and stood in water only six or eight inches deep. When the house was disturbed a muskrat escaped by a hole which entered the mud beneath the house and emerged several feet from it.

Muskrats often were seen abroad in the late afternoon, especially during the winter. On December 21, 1927, at four P.M., eight muskrats were swimming about in an open lagoon. One of these entered a hole in the bank, from which it emerged again in great haste, closely pursued by another rat. On several occasions muskrats were seen walking about on top of the ice. At one place a muskrat trail led three hundred yards through soft snow from one lagoon to another.

In Ruby Lake the food of muskrats consisted primarily of the white bases of the stems of tules (*Scirpus acutus*). These were not eaten immediately upon being brought to the surface but were carried to an established feeding place, which usually was upon a mat of floating tules. (See pl. 5.)

On June 27, 1928, two adult muskrats were found following trails which ran through shallow water and mud among short scattered tules and water grass. Upon being approached they "froze" to the mud with their necks outstretched. When touched, one of them ran for the nearest water; the other reared upon its hind legs prepared to fight.

On May 23, 1928, three young muskrats, with their eyes still closed, were found in the tule house described above. They were covered with short, smooth, dark brown hair. Two of them measured, respectively, 153 and 159 millimeters in length. Half-grown young were taken on various dates between July 18 and December 21.

Our series indicates that, on the average, young muskrats are darker in color than are adults taken at the same season, and also that winter pelage is darker than summer pelage. Four adults, taken in the latter part of June and in July, are in a very light colored and worn pelage. Our series shows no difference in size between the males and females of the same age.

Although Ruby Lake lies on the northeastern border of the known range of *Ondatra zibethica mergens*, specimens from there do not show intergradation with *Ondatra z. osoyoosensis*, the race found to the northeast. Hollister (1911, p. 28) recorded four specimens of *Ondatra zibethica mergens* from "Ruby Lake."

Average measurements of ten adults (8 males and 2 females) from Ruby Lake are as follows: Total length, 555.7 mm.; tail, 240.7; hind foot, 78.6; basilar length of skull, 59.8; zygomatic breadth, 41.0; length of nasals, 22.1; alveolar length of upper molar series, 15.0.

Zapus princeps nevadensis Preble

Nevada Jumping Mouse

From Willow Creek; Harrison Pass Ranger Station; Long Creek; Summit of Secret Pass; Steels Creek; and head of Ackler Creek. Sixty-sight specimens.

Jumping mice were common residents of riparian associations throughout the entire range. Altitude apparently had little bearing on their distribution, as they were taken at various levels from 6500 to 9800 feet, wherever the required habitats were found. They were most numerous in heavy vegetation and rarely were they trapped more than a hundred feet from water.

Usually jumping mice were not seen in daylight unless frightened from their globular nests, which were placed on the surface of the ground in tall grass.

Between June 22 and 27, five half-grown young were captured. Between June 3 and July 4, five pregnant females were taken; two of these contained six embryos each, two contained four embryos each, and the fifth contained seven embryos.

Five adult specimens taken between June 21 and July 12 are molting. The old hair is thin, worn, and in some specimens spotted. The new hair can be seen coming in beneath the old hair, and it is growing uniformly over head, back and sides.

This species, described by Preble (1899, p. 25) from a single specimen taken in the Ruby Mountains, recently has been compared with geographically adjacent races by Hall (1931, pp. 7, 8).

Erethizon epixanthum epixanthum Brandt

Yellow-haired Porcupine

From Willow Creek; west side of Ruby Lake, White Pine County, 3 miles south of the Elko County line; Kleckner Creek; and Jerry Creek. Ten specimens.

Trees which had been gnawed, and other signs indicated that porcupines were widely distributed and fairly common throughout the Ruby Mountains. A number of their dens were found among the rocks. Although sign of porcupines was found about each of our camp sites, few of the animals were actually encountered. This is due to the fact that they are mainly nocturnal, and when they are out during the day, they usually remain motionless at the approach of danger and thus avoid detection. Their tracks are easily recognized, as the soles of their feet are very rough, and, as a result, they make beaded impressions in the dust. The heavily bristled tail usually brushes the ground leaving an undulating trail, partly obscuring the footprints. The stiff bristles on the feet often leave small brush-like marks on the outside of each beaded imprint. One morning at nine o'clock a porcupine that was not aware of the observer's presence was seen as it walked slowly along a trail which ran between some timber and a rock slide. Evidently it was just returning to its daytime retreat, for it soon left the trail and entered the rock slide. Examination revealed a typical porcupine den with its accumulation of droppings and quills and the characteristic musky odor.

In some places the gnawings of porcupines on pinyon and limber pine trees were much in evidence. One individual was found foraging in a large service berry bush, another in a willow tree, and a third in a chokecherry.

Seven specimens taken between February 10 and March 16 are in heavy winter pelage, which consists of three types of hair: dense under-fur; long, coarse, and sparsely growing guard hair; and quills. (See pl. 4.)

Our series of ten specimens shows that the males are larger than the females and that the individual differences in skull characters are extreme as compared with those found in most other rodents.

Ochotona princeps nevadensis Howell

Nevada Pika

From Long Creek; Three Lakes; and Steels Creek. Nineteen specimens.

Pikas were nowhere abundant, but throughout the range most of the rock slides above 8500 feet altitude harbored at least a few. They were timid and they generally disappeared among the talus at our approach. Usually when a slide was inhabited by pikas, some individual would announce its presence with the characteristic call-note, uttered from a lookout-rock or from a retreat beneath the talus. However, on other occasions, we were able to evoke no sound from the pikas although we knew they were present.

Late in the summer the pikas were busy storing a food supply for the winter in the form of "hay." These "hay piles," located under overhanging rocks, were composed of the different plants which grew in or about the edges of the slides. One "hay pile" examined August 13, 1928, at Three Lakes was composed almost entirely of cinquefoil (*Potentilla breweri*). All of the plants used were in blossom. Beneath the new hay was old hay, showing that the place had been used for storage purposes during previous years.

Young pikas of various sizes were seen commonly about Three Lakes during late July and early August, 1928. The condition of one female taken July 7, 1928, at Three Lakes, showed that it was suckling young. Three pikas, less than half-grown, collected between July 13 and July 30, 1928, were in the soft, grayish buff, juvenile pelage. Two other young individuals taken August 9 and 11, respectively, were almost fully grown. They had lost their juvenile pelage and had acquired new coats, cinnamon-tan in color. Eight adults captured between June 17 and August 11, 1928, were in much worn pelage. Three of these, taken during the first part of August, had acquired new pelage over the head and shoulders.

The subspecies *Ochotona princeps nevadensis* was described by A. H. Howell (1919, p. 107) from three specimens obtained in the Ruby Mountains. Our nineteen topotypes of *nevadensis*, as compared with five adult, two subadult, and two juvenile specimens of *Ochotona uinta* in comparable pelage from the Uinta Mountains, Utah, and the Salt River Mountains, Wyoming, show the upperparts of *nevadensis* to be noticeably lighter in color. This is the most outstanding difference between these two forms, according to Howell (*loc. cit.*). He states also that the sides of the nose and face of *nevadensis* are more extensively grayish than are the same parts of *uinta*; this difference is not borne out by our specimens.

The skull of *nevadensis* is actually shorter and both relatively and actually broader than that of *uinta*. This is shown by the fact that the mean occipito-nasal length of the two largest skulls of *nevadensis* and of *uinta* available is 44.5 and 45.8 millimeters, respectively. The mean zygomatic breadth of the same two skulls, is, respectively, 22.6 and 22.2 millimeters. The females show less difference in these proportions than do the males. The infra-orbital fenestrae of *nevadensis* are a little more rounded than are those of *uinta*.

Average measurements in millimeters of three adult males and three adult females of *Ochotona princeps nevadensis* from the Ruby Mountains are as follows: Total length, 189; 196; hind foot, 31.3; 31.3; occipito-nasal length, 44.3; 44.0; zygomatic breadth, 22.2; 21.2; breadth of braincase, 18.6; 18.1; interorbital breadth, 5.4; 5.1; width of palatal bridge, 2.3; 2.1; length of nasals, 14.6; 14.6.

Lepus townsendii townsendii Bachman

White-tailed Jackrabbit

Although abundant locally this hare had a limited distribution within our area. None was seen on the west side of the mountains, nor anywhere above 7000 feet altitude. Most of the animals were found in a narrow strip of country, between 6000 and 7000 feet altitude, which extends from the Ruby Valley Post-office north to the east entrance of Secret Pass and Pole Canyon. All of our 22 specimens were taken in the area described above. Here the species was still further limited by habitat requirements; it showed a decided preference for meadows and alfalfa- or grain-fields which were bordered by willow thickets, wild rose, antelope brush, or other heavy cover. A few individuals were seen also in the northern end of the range in the vicinity of Steels Creek. Residents reported that white-tailed jackrabbits formerly were much more widely distributed throughout the Ruby Mountains.

During the winter we found these rabbits occupying exactly the same areas that they occupied during the summer, but that they were found more often about ranchers' hay stacks.

White-tailed jackrabbits were more nocturnal than the black-tailed jackrabbits. During the day no white-tails were seen unless they were "jumped" from cover. At dusk three or four times as many black-tails as white-tails were observed, but as night advanced this proportion began to change, and after nine o'clock the two species were seen in nearly equal numbers along that part of the road which ran through the territory occupied by the two species. During a drive after dark from Ruby Valley Post-office to Secret Pass and return, we would see from three to thirty "mountain hares," about twelve being the average number.

The eyes of this species responded more readily to light reflection than did the eyes of any other species of rabbit inhabiting our territory. When we directed a flashlight or the headlights of the automobile toward one of these rabbits, its eyes returned a fiery red reflection. The shine of its eyes was so much redder and more brilliant than the shine of the eyes of the black-tailed jackrabbit that the two species usually could be

distinguished at night by the difference in color of the light reflected by their eyes. However, this eye-shine was not invariably manifested. On the night of December 19, 1927, when we saw fifteen white-tailed jackrabbits, and on the night of December 24, when we saw thirty, none of their eyes reflected the light from the car or the flashlight. Since at this period of the year, the rabbits were in the white coat and the ground was entirely covered with snow, we think sufficient light may have been reflected by the snow and the white fur of the rabbits to obscure the reflected light from their eyes.

Our observations did not show these rabbits to be unsociable, as some writers believe (Seton, 1929, vol. 4, p. 654). On one occasion, four adults of this species were seen within the area lighted by the headlights of the car. On another occasion, three adult males were feeding in a grain field within an area not more than six feet in diameter. The white-tailed and black-tailed jackrabbits showed no animosity toward each other. Several times individuals of the two species were seen within a few feet of each other.

Four females were taken on June 3, four others on June 25, one on July 8, and another on August 10. All were suckling young. Half-grown white-tailed jackrabbits were seen on various dates between June 25 and August 10. This extended breeding period suggests that in the Ruby Mountains at least two litters are produced each season.

Our series, consisting of 17 skins, includes adult and immature specimens of both sexes taken in the summer, fall, and winter. Specimens of corresponding dates are comparatively uniform in color. The summer pelage is decidedly gray and shows but little of the yellowish buffy color which is characteristic of *Lepus townsendii campanius*. The tails of our specimens are entirely white, except in two, each of which shows a mere trace of black on the dorsal side. Eleven specimens of this species, taken December 19 and December 24, are entirely white except for the feet, crown, and ears, which vary from brown to gray. The light brown under-fur of the back does not show through the outer-fur. When compared with specimens of *Lepus t. sierrae* our specimens are seen to differ in having the black on the ears more restricted, and in a few cases the black is replaced by dark brown.

Average and extreme measurements in millimeters of ten adult specimens from the Ruby Mountains are as follows: Total length, 608.0 (580–640); tail vertebrae, 82.1 (66–102); hind foot, 154.0 (145–165); ear from notch (in dry skin), 104.0 (96–112); ear from skull, 136.0 (123–151); basilar length, 71.5 (68.4–74.8); length of nasals, 35.3 (33.8–37.3); breadth of rostrum above premolars, 24.7 (23–26.4); interorbital breadth, 28.8 (24.3–32.9); parietal breadth, 32.1 (30.5–32.8); diameter of bullae, 11.2 (9.8–11.9).

Comparison of the above measurements with those given by Nelson (1909, p. 74), shows that in most cases the Ruby Mountains specimens are intermediate between *townsendii* and *sierrae*. Nelson (*op. cit.*, p. 82) has recorded two specimens of *townsendii* from "Ruby Valley."

Lepus californicus deserticola Mearns

Black-tailed Jackrabbit

From west side of Ruby Lake, points 3, 6, and 16 miles north of the White Pine County line; Harrison Pass Ranger Station; and Jerry Creek. Eight specimens.

Black-tailed jackrabbits were found commonly throughout our territory below 7000 feet. During the summer of 1928, two members of our field party and several residents of the region contracted tularemia, presumably from the rabbits which were known to be infected at that time. The following spring, jackrabbits were less numerous in some areas, but still were common in other parts of our territory. The disease may have decreased the numbers of rabbits in small areas, but it did not have a drastic effect upon the rabbit population of the whole region.

Black-tailed jackrabbits always were more in evidence at dusk than at any time of the

day or than after dark. On one occasion at dusk, fourteen were counted feeding in a small alfalfa patch. This species occupied the same areas during mid-winter that it did during the summer.

Young of various sizes were seen from June 20 to August 10. Two females which were suckling young were taken May 25, 1928.

Our eight specimens of black-tailed jackrabbit are referred to the form *Lepus californicus deserticola*, although they are not entirely typical. Compared with specimens of *deserticola* from the Colorado River, California, our specimens are considerably grayer above and are more pinkish buffy on the sides. This indicates a tendency to intergrade with the subspecies *wallawalla*.

Sylvilagus nuttallii grangeri (Allen)

Black Hills Cottontail

From Willow Creek; west side of Ruby Lake, Elko County, 3 miles north of the White Pine County line; west side of Ruby Lake, Elko County, 6 miles north of the White Pine County line; Harrison Pass Ranger Station; Jerry Creek; Steels Creek; and one specimen from 10 miles south of Secret Pass. Sixteen specimens.

Cottontails were common throughout the lower altitudes of the region; rarely were they seen above 8000 feet. Stream beds overgrown with willows and heavy brush, or flats covered with dense sagebrush and rabbit-brush, composed their preferred habitats.

Two female cottontails taken on June 27 and July 2, 1929, contained four and six embryos, respectively. A female captured May 24, 1929, was suckling young.

An adult female taken May 24, 1929, is in very worn pelage, and the new coat is well started beneath the old worn hair. Two adults collected October 23 and 24, 1929, are in full winter pelage.

In this region cottontails were preyed upon rather extensively by the larger raptorial birds. Since cottontails were abroad both day and night they were subjected to the attacks of both hawks and owls. Stomach examinations showed that two cottontails had been eaten by horned owls, one by a long-eared owl, two by red-tailed hawks, one by a Swainson hawk, and one by a marsh hawk.

Although the cysts of tapeworms were most commonly found in black-tailed jackrabbits, they were found also in white-tailed jackrabbits and occasionally in cottontails.

Sylvilagus idahoensis (Merriam)

Pigmy Rabbit

From west side of Ruby Lake, Elko County, 3 miles north of White Pine County line; west side of Ruby Lake, Elko County, 6 miles north of White Pine County line; Arizona Springs; Jerry Creek; and 3 specimens from near Ruby Valley Post-office. Eleven specimens.

Pigmy rabbits were found at various places in our area below 6500 feet altitude, but they were so scarce that not more than thirty individuals were seen during the entire survey. They lived in the heaviest patches of sagebrush available (see pl. 6), and in most cases excavated their own burrows, but occasionally they used deserted badger burrows.

Our observations on the habits of this species indicate that it was abroad as frequently during the day as at night. Their eyes reflected only dimly the beam of a powerful spot light, which may further indicate that this species is primarily diurnal.

Three young pigmy rabbits were taken on May 27, June 25, 1928, and June 28, 1929, respectively.

Two adults collected May 20, 1928, and June 27, 1929, are in badly worn pelage,

whereas two adults taken July 22 and 27, 1927, had already completed the moult and had acquired new fall pelage.

The remains of one pigmy rabbit were found in the crop of a long-eared owl.

Pigmy rabbits previously have been recorded from our section, as from "Skelton" (see Nelson, 1909, p. 278). For use of the generic name *Sylvilagus* rather than *Brachylagus*, see Grinnell, Dixon and Linsdale (1930, pp. 558–562).

Odocoileus hemionus hemionus (Rafinesque)

Mule Deer

Deer ranged throughout the Ruby Mountains, but were nowhere numerous. Their numbers were undoubtedly kept down by lack of sufficient cover and forage plants of the required type. The area probably never supported ideal vegetation for deer. Heavy grazing by sheep and cattle has greatly reduced the already insufficient forage crop. Improved grazing regulations now in force by the United States Forest Service will help to restore the former conditions and may result in an increase in the number of deer.

In the fall the deer moved out of the mountains to the lower slopes, and as winter approached they moved to the southern end of the range, and some left the range entirely. During October and November, 1929, they favored especially the lower slopes which supported a good growth of mountain mahogany, juniper, pinyon, and brush. On December 23, 1927, we found the tracks of two deer that had been feeding on serviceberry brush which projected above the snow in a well-wooded canyon six miles north of Hobson.

We examined four bucks that had been killed in the Ruby Mountains between October 1 and 15, 1929. One of these had been killed in the north end of the range near Polar Star Mine, another in Harrison Pass, and two near Hobson. The buck taken in Harrison Pass was a large one with extremely wide and heavy antlers. Two of the others were good-sized four-point bucks; one of these weighed 156 pounds with viscera removed. The fourth was a small forked-horn.

On October 14, 1929, a doe with two large fawns was observed near Hobson, and on the same day two large bucks were seen together. A few days later another doe with two fawns was seen. None of the fawns was in the spotted juvenile coat.

In the fall there was little water in the southern end of the range and the deer often came down out of the hills to drink from Ruby Lake or from the springs along its western shore. In order to reach the lake they were forced to cross half a mile or more of open sagebrush and grass-covered flats, and also a barbed-wire cattle fence. At seven o'clock in the morning of October 20, 1929, seven does were seen in the meadow along the western shore of Ruby Lake. At sight of us, they crossed the fence and ran straight for the timber on the nearest slope. Near the timber they were joined by another doe, making eight in the herd. Three of them were considerably larger than the others, but none appeared to be fawns of the year. Examination showed that most of the herd did not jump over the fence but crawled through or under the somewhat sagging barbed wires. A few days previously a large buck easily jumped this fence when frightened by the approach of our car.

Only one deer, a four-point buck, was obtained as a specimen. The measurements (in millimeters) of this deer are: Total length, 1710; hind foot, 585; tail, 134; length of metatarsal gland, under tuft, 152, over tuft, 160. Its stomach contained rabbitbrush and mountain mahogany.

Antilocapra americana americana (Ord)

Antelope

None of our party saw any evidence of antelope within our territory. Mr. August Rohwer writes that in the spring of 1924, he saw five antelope at the head of Jerry Creek, but that he has seen none since. Several residents of long standing reported that at one time antelope were numerous in Ruby Valley and along the east base of the Ruby Mountains.

Ovis canadensis (subsp.?)

Mountain Sheep

The only material evidence obtained of the presence of mountain sheep in the Ruby Mountains was one pair of well-preserved horns found on a rocky ridge above Three Lakes at about 10,000 feet altitude, and a portion of a skull picked up near the head of Willow Creek canyon.

Mr. August Rohwer, who has ridden over the Ruby Mountains as a Forest Ranger since 1915, reports that he saw one or two mountain sheep on several occasions between the years 1915 and 1921. He reports further that he saw three mountain sheep at the head of Smithers Creek (near Verdi Lake) in October, 1921; but he has not seen or heard of any in the Ruby Mountains since that date.

Mr. William Toyn informed us that he saw mountain sheep in Green Mountain Basin in 1897 or 1898, and that three or four were in the head of Lamoille Canyon during the winter of 1904–1905.

Mr. Owen Vaughn writes that about 1890 he saw as many as thirty mountain sheep in one band and that he observed other small bands in the course of a day's ride in the Ruby Mountains; but he has not seen any since 1896. Both Mr. Toyn and Mr. Vaughn have lived in the vicinity of the Ruby Mountains for the past fifty years.

LITERATURE CITED

ALLEN, J. A. 1894. Cranial variations in *Neotoma micropus* due to growth and individual differentiation. Bull. Amer. Mus. Nat. Hist., vol. 6, pp. 233–246, pl. 4.

BAILEY, V. 1900. Revision of the American voles of the genus *Microtus*. U. S. Dept. Agric., North Amer. Fauna, no. 17, 88 pp., 5 pls., 17 figs. in text.

1915. Revision of the pocket gophers of the genus *Thomomys*. U. S. Dept. Agric., North Amer. Fauna, no. 39, 136 pp., 8 pls., 10 figs. in text.

GRINNELL, J., DIXON, J., and LINSDALE, J. M. 1930. Vertebrate natural history of a section of northern California through the Lassen Peak region. Univ. California Publ. Zool., vol. 35, 594 pp., 181 figs. in text.

HALL, E. R. 1931. Critical comments on mammals from Utah, with descriptions of new forms from Utah, Nevada and Washington. Univ. California Publ. Zool., vol. 37, pp. 1–13.

HALL, E. R., and GILMORE, R. M. 1932. New mammals from St. Lawrence Island, Bering Sea, Alaska. Univ. California Publ. Zool., vol. 38, pp. 391–404, pls. 5 and 6, 1 fig. in text.

HOLLISTER, N. 1911. A systematic synopsis of the muskrats. U. S. Dept. Agric., North Amer. Fauna, no. 32, 47 pp., 6 pls., map.

HOWELL, A. H. 1901. Revision of the skunks of the genus *Chincha*. U. S. Dept. Agric., North Amer. Fauna, no. 20, 62 pp., 8 pls.

1915. Revision of the American marmots. U. S. Dept. Agric., North Amer. Fauna, no. 37, 80 pp., 15 pls., 3 figs. in text.

1919. Descriptions of nine new North American pikas. Proc. Biol. Soc. Washington, vol. 32, pp. 105–110.

1924. Revision of the American pikas. U. S. Dept. Agric., North Amer. Fauna, no. 47, 57 pp., 6 pls., 4 figs. in text.

1928. Descriptions of six new North American ground squirrels. Proc. Biol. Soc. Washington, vol. 41, pp. 211–214.

1929. Revision of the American chipmunks (genera *Tamias* and *Eutamias*). U. S. Dept. Agric., North Amer. Fauna, no. 52, 157 pp., 10 pls., 9 figs. in text.

Jackson, H. H. T. 1928. A taxonomic review of the American long-tailed shrews (genera *Sorex* and *Microsorex*). U. S. Dept. Agric., North Amer. Fauna, no. 51, 238 pp., 13 pls., 24 figs. in text.

Nelson, E. W. 1909. The rabbits of North America. U. S. Dept. Agric., North Amer. Fauna, no. 29, 314 pp., 13 pls., 19 figs. in text.

Osgood, W. H. 1909. Revision of the mice of the American genus *Peromyscus*. U. S. Dept. Agric., North Amer. Fauna, no. 28, 285 pp., 8 pls., 12 figs. in text.

Preble, E. A. 1899. Revision of the jumping mice of the genus *Zapus*. U. S. Dept. Agric., North Amer. Fauna, no. 15, 42 pp., 1 pl., 4 figs. in text.

Ridgway, R. 1877. United States geological exploration of the fortieth parallel. Clarence King, geologist in charge, vol. 4, pt. 3, pp. 303–643 and index, pp. 652–669.

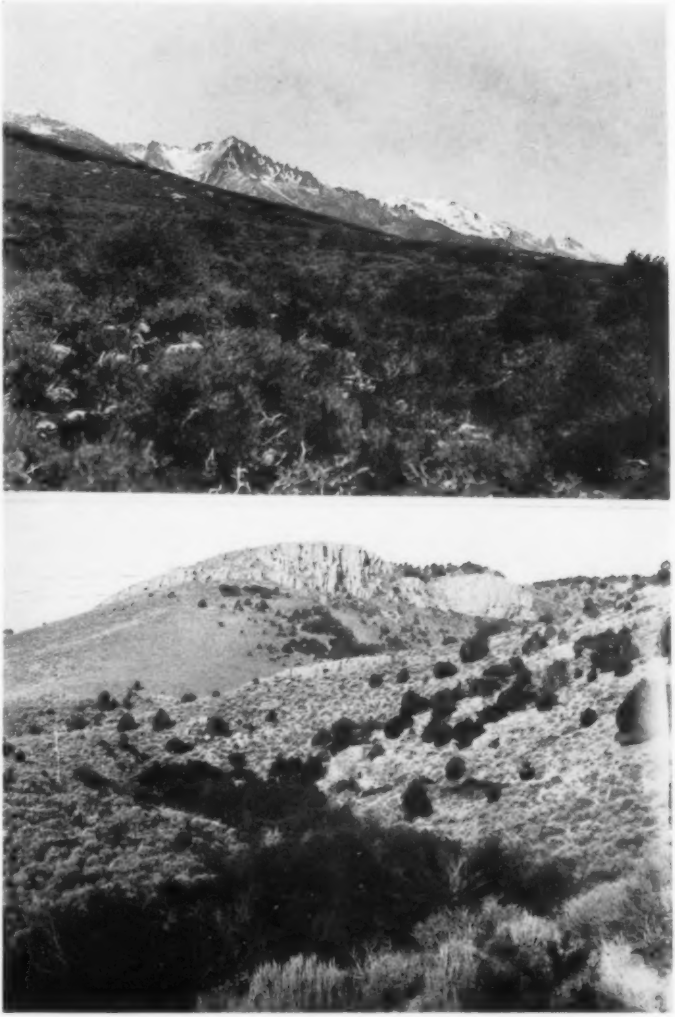
Seton, E. T. 1929. Lives of game animals. (Doubleday, Doran & Co., Inc., New York), vol. 4, 949 pp., illustrated.

Taylor, W. P. 1911. Mammals of the Alexander Nevada expedition of 1909. Univ. California Publ. Zool., vol. 7, pp. 205–307.

Thomas, O. 1905. Suggestions for the nomenclature of the cranial length measurements and of the cheek-teeth of mammals. Proc. Biol. Soc. Washington, vol. 18, pp. 191–196, 1 fig. in text.

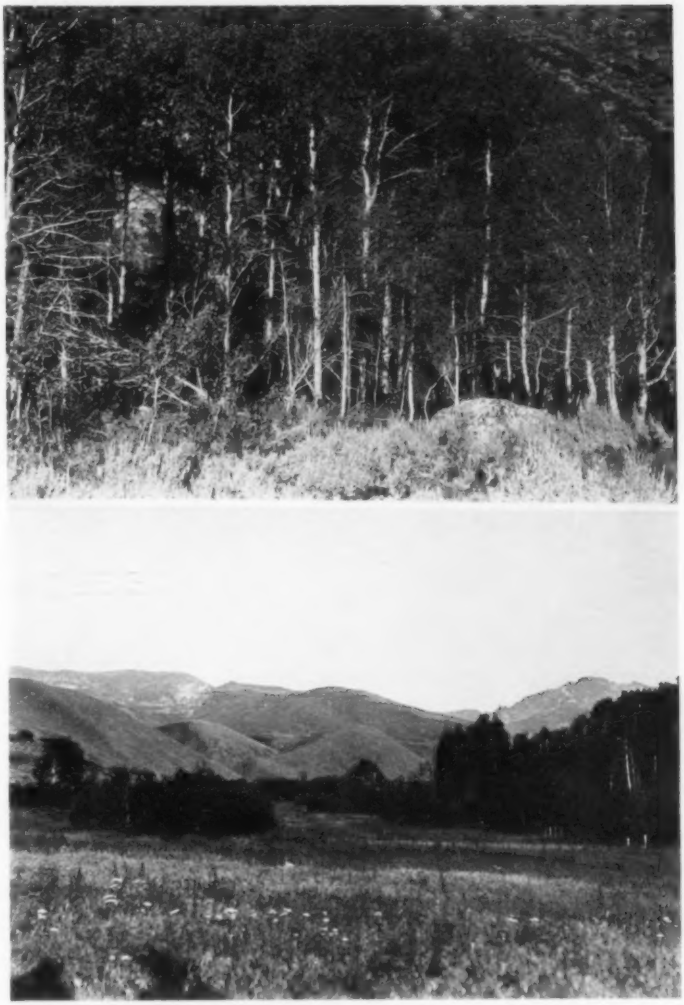
Transmitted April 1, 1933.

Care of Museum of Vertebrate Zoology, Berkeley, California and 2420 Ridge Road, Berkeley, California.



UPPER. Part of the Ruby Mountains, looking north from Harrison Pass; early June, 1929. Foreground shows typical habitat of *Sylvilagus idahoensis*, *Lepus c. deserticola* and *Eutamias m. pictus*.

LOWER. Chokecherries about a spring and its outlet; slopes covered with sagebrush, pinyon and juniper. Camp no. 3 in June, 1928, among chokecherries in center. *Peromyscus m. sonoriensis*, *Eutamias m. pictus*, *Perognathus p. olivaceus*, and *Sylvilagus idahoensis* found on these slopes.

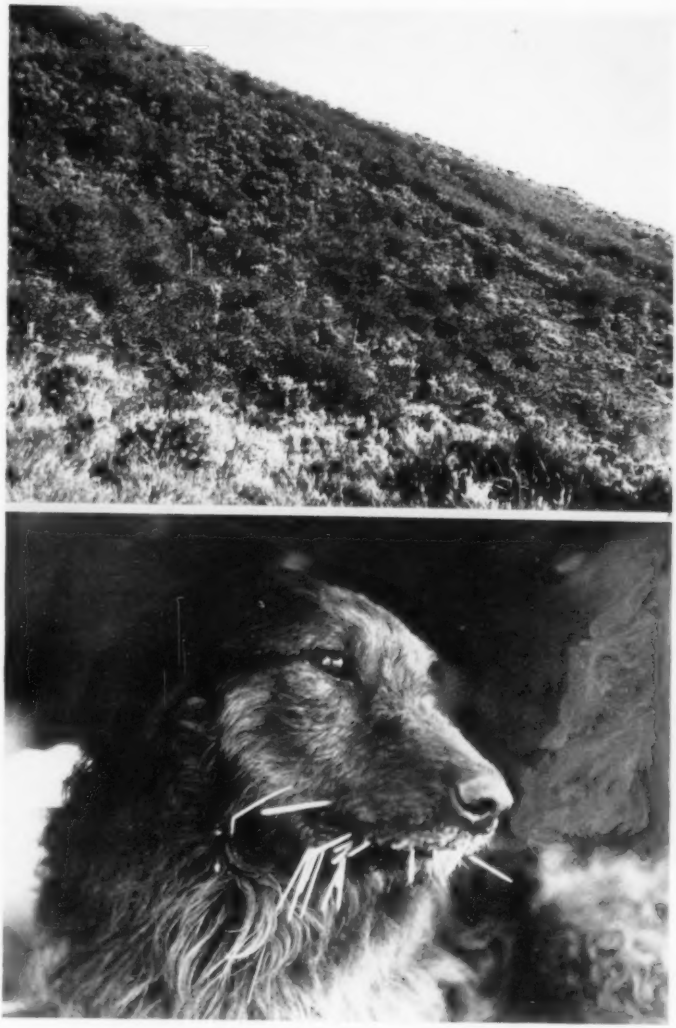


UPPER. Camp site no. 12 in stand of small aspens on Ackler Creek at 8000 feet altitude; July 6, 1929. This was typical of the growth found along many of the streams. *Zapus p. nevadensis*, *Sorex v. amoenus*, *Sorex p. navigator* and *Microtus m. mordax* trapped here.

LOWER. Valley at mouth of Ackler Creek (locality no. 13); July 9, 1929. The aspen, willow, and wet meadows provide suitable habitats for *Sorex v. amoenus*, *Microtus m. montanus* and *Zapus p. nevadensis*.

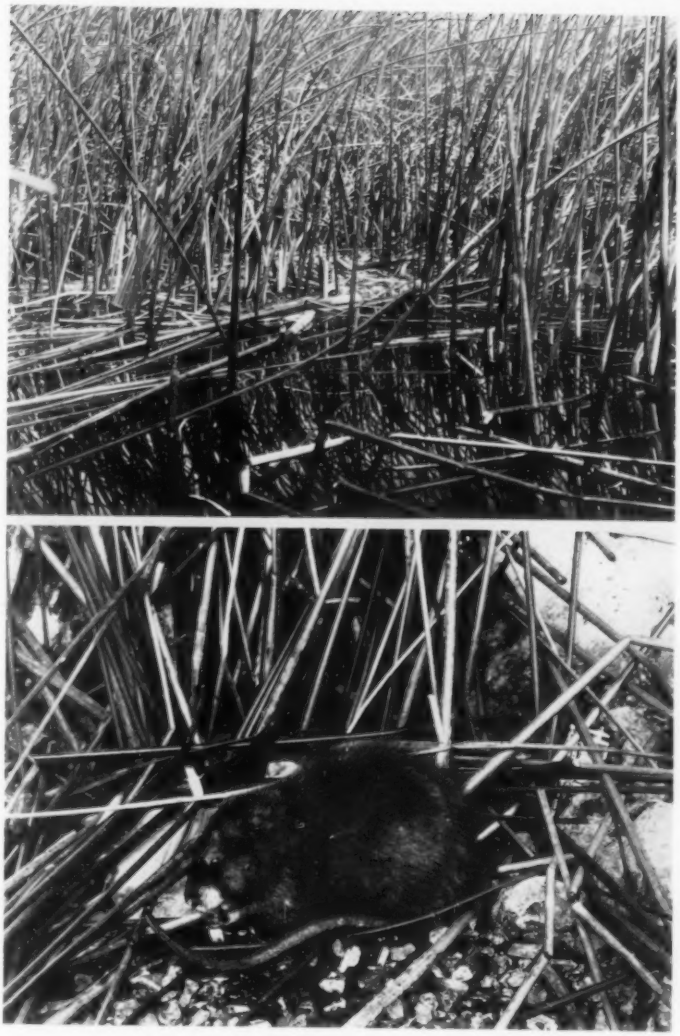
UPPER. Aspen stumps cut by beaver on Toyn Creek, near summit of Harrison Pass, and now beginning to decay; no beaver now present; June 27, 1928.

LOWER. Rimrock in the lower canyons in southern part of Ruby Mts., 6500 feet altitude; June 12, 1928. Pinyon, juniper, and sagebrush; typical habitat of *Peromyscus crinitus, Peromyscus truei, Neotoma cinerea* and *Lynx rufus*.



UPPER. Slope above camp site no. 4 in Green Mountain Canyon. The plant cover is mainly sagebrush (*Artemisia tridentata*) and service berry (*Amelanchier utahensis*). More *Lagurus* trapped here than at any other place.

LOWER. Ranch dog after encounter with a porcupine; June 6, 1928.



UPPER. Common tule (*Scirpus acutus*) in shallow water; this type covered much of Ruby and Franklin lakes. Muskrat feeding place in center; note tules dragged in by muskrat and shredded remains of those eaten. Ruby Lake, locality no. 3, July 28, 1927.

LOWER. Recently captured muskrat feeding on white base of tule. Note method of holding food in fore-paw. Ruby Lake, locality no. 3, July 28, 1927.

UPPER. Crest of Ruby Mountains, from summit of Liberty Pass, looking across Three Lakes, Liberty, Favre, and Castle, August 5, 1928. Camp site no. 8 on near side of Castle Lake. Talus slope in left foreground favorite habitat of pikas and marmots.

LOWER. Pigmy rabbit (*Sylvilagus idahoensis*) in natural habitat among sagebrush. Ruby Lake, locality no. 3, July 22, 1927.

THE GENERA AND SUBGENERA OF SOUTH AMERICAN CANIDS

By Wilfred H. Osgood

In recent years a considerable series of South American canids has accumulated in Field Museum, including most of the important species. The Falkland Island Dog, of course, is absent, and typical *Lycalopex vetulus* is unrepresented, but these have been repeatedly described and figured both as to external appearance and as to detailed cranial and dental characters. A review of the material in hand and the pertinent literature is compelling as to the common relationship of all South American Caninae and their common distinction from *Canis* by a set of characters which runs through the entire group, even including *Urocyon* and *Chrysocyon*. Moreover, examination of several little known species and of extensive series of certain others indicates that connections between nominal "genera" are closer than has been hitherto supposed.

The taxonomic and nomenclatural history of the group shows a rapid and almost complete reversal of the conservatism which permitted Lydekker, in 1896 (Geog. Hist. Mamm., p. 140) to state that "the Falkland Island wolf (*Canis antarcticus*), which differs markedly from all the Canidae of the mainland, is apparently closely allied to the North American coyote (*Canis latrans*)." Scharff, in 1912 (Distribution and Origin of Life in America, p. 150), relying upon Lydekker, found himself in difficulties with both sections of this statement, first as to the supposed distinctness of *Canis antarcticus* among its neighbors and second as to its supposed affinity with the coyote. He called for help and thus started a series of studies which have been increasingly analytical and increasingly given to the multiplication of genera until a point has been reached where nearly every well-defined species has its own generic name. The thought that there might be a desirable middle ground seems to have received scant consideration, and one wonders whether or not a writer like Scharff would now find himself less bewildered by the overabundant genera of Thomas and Cabrera than he was by the misinformation of Lydekker.

Led to do so by reviewing the work of Scharff, Pocock in 1913 (Proc. Zool. Soc. London, pp. 382–393, figs. 70–74) made an earnest effort to find superspecific characters distinguishing at least one of the South American forms (*australis*, syn. *antarcticus*) from typical *Canis* as represented by *C. latrans*. He found the Falkland Island dog to differ from *Canis* in its rather short white-tipped tail and in the following cranial and dental characters: sagittal area flattened and lyriform; occipital crest truncated and overhanging the supraoccipital but little; masseteric ridge of jugal near middle of its surface; upper carnassial with protocone drawn somewhat backward; lower carnassial with metaconid only slightly higher than talonid. These characters have been used by later authors and subdivided for special groups. Examination

of a series of skulls of various species indicates that some of the characters are quite invalid while others represent general tendencies which collectively distinguish South American canids from typical *Canis*. If Pocock had used *culpaeus* instead of *australis* for his comparisons with *latrans*, he would have found a little more similarity. However, he demonstrated the essential difference of *australis* from *latrans* and at the same time showed its common heritage with other South American canids.

In March, 1914, Thomas (Ann. & Mag. Nat. Hist., ser. 8, vol. 13, pp. 350–352) reduced confusion in the names of the group and recognized no less than five genera, but without any mention of generic characters. At about the same time (Field Mus. Nat. Hist., Zool. Ser., vol. 10, pp. 172–174, April, 1914), I referred to the substantial contribution of Pocock and expressed a lack of faith in conclusions not based on "an exhaustive phylogenetic study" or "more thorough investigation than has yet been made." In 1930 an important study appeared by the Argentine paleontologist, Kraglievich (Physis, vol. 10, pp. 35–73, figs. 1–12, pls. 1–7) which at least to some extent supplied these desiderata. Leaving aside *Speothos*, which was placed in a separate subfamily, he recognized in effect only two genera of South American canids, *Lycalopex* and *Canis*, the last with four subgenera *Cerdocyon*, *Chrysocyon*, *Pseudalopex*, and *Dusicyon*. By this arrangement he stressed the common characters of these four subgenera, and while also expressing their individuality, he furthermore recognized what he regarded as their common lack of great distinction from *Canis*. This is a great deal for classification and nomenclature to do and at least in principal it seems doubtful whether or not any serious disturbance of it is an improvement.

Following Kraglievich, Cabrera made an exceedingly valuable contribution to the subject in 1931 (Journ. Mamm., vol. 12, pp. 54–67). In this paper nomenclatural issues were thoroughly clarified, many nominal species and subspecies were properly allocated, and a "tentative key" to "genera" was presented. It is difficult to disagree with such a competent study, but Cabrera's groups are essentially the same as those of Thomas; subgenera are wholly eschewed, and we have five genera of South American Caninae without any nomenclatural recognition of their common phylogeny and relationship to each other. The characters used to support the divisions, although based on careful and accurate observation, are mostly relative rather than absolute, that is, they express varying degrees of tendencies which run through the whole group. In some cases they are subject to such interspecific variation that confidence in their greater significance is lost. Thus the facio-cephalic index of "*Pseudalopex*" *sechurae* is about 46 while in an average skull of the closely related "*P.*" *griseus* it is 50, a difference almost as great as that between *Lycalopex* and the other "genera." Again it is found that the position of the masseteric ridge in *culpaeus* and *griseus* varies to the full extent of the supposed difference between *Pseudalopex* and *Cerdocyon*.

When characters of this kind are excluded, the remaining distinctions are few and, although doubtless important, they are not to my mind sufficient to justify full generic separation.

The common affinity of all South American Caninae and their collective distinction from *Canis* may be expressed synoptically as follows:

Upper carnassial highly developed, its length equal to or greater than combined length of two upper molars; occipital shield nearly triangular, its apex not depressed nor truncated; sagittal crest a simple ridge rarely showing any tendency to the formation of a flattened lyrate area; upper incisors heavy, the outer pair extending much beyond the middle of the canines which are short and heavy; inner pairs of upper incisors very distinctly trifid.... *Canis* (*lupus, latrans*, etc.)

Upper carnassial reduced, its length always less than combined length of two upper molars; occipital shield depressed or truncated at its apex, the sagittal and lambdoid crests meeting at little less than an angle of forty-five degrees; sagittal area (at least in females) usually flattened and lyrate (except in *Chrysocyon*); upper incisors weak, the outer pair scarcely or not extending beyond the middle of the canines which are long and slender; inner pairs of upper incisors imperfectly or not trifid.

Urocyon, Lycalopex, Dusicyon, Cerdocyon, Pseudalopex, Chrysocyon

After having made this grouping, if we undertake subdivision, we find that distinctions within the southern group must be based largely upon varying degrees of development of one or more of the same characters which distinguish the group as a whole. The small teeth and reduced carnassial of *Lycalopex*, for example, appear to be only extreme expressions of something common to the group and, moreover, something which is subject to considerable variation in other members of the group. Thus the upper molar index, which may be given a maximum of 150 for *Lycalopex vetulus*, falls to about 125 in *Pseudalopex griseus*, but may reach 145 in *P. sechurae*. Therefore, there is more difference in this respect between *gracilis* and *sechurae* than there is between *sechurae* and *vetulus*. In several other respects *sechurae* approaches *vetulus*, its muzzle being relatively short (cranio-facial index 46), its upper molars less extended transversely than in *griseus*, and its third upper premolar oblique and overlapping the second internally as in *vetulus*. In fact it almost raises the question as to the reference of *sechurae* to *Lycalopex* instead of to *Pseudalopex*. In describing *sechurae*, Thomas (Ann. Mag. Nat. Hist., ser. 7, vol. 5, p. 149, 1900) mentions the relatively small carnassial, but dismisses the skull as "practically identical with that of the Chilla [*griseus*]." Several specimens of *sechurae* in Field Museum, however, indicate that it is quite distinct. In fact it was the examination of these specimens in connection with Chilean material that first raised doubts as to the value of some of the characters used for generic distinctions in the group.

Another species which does not conform to previous generic characterizations appears in the *Canis microtis* of Sclater. This is a very rare dog, heretofore known only from the original type. Through the courtesy of Mr. H. E. Anthony, I have lately been privileged

to examine three specimens in the American Museum of Natural History, two from the vicinity of Lagarto, upper Ucayali River, Peru, and a third obtained through the New York Zoological Society and probably from the same general region. These specimens show this species to be a very distinct one with many peculiarities and it offers such a combination of characters that even its subgeneric allocation is somewhat puzzling. Although the skins do not suggest an animal of exceptional size, the skulls are very large and heavy, with correspondingly heavy teeth, and on comparison these prove to be considerably larger than in any other South American dog except *Chrysocyon*. The facial part and the dorsal outline of the skull are much as in *Cerdocyon* and the angle of the mandibular condyle is heavy; but here the resemblance stops. The masseteric ridge of the jugal is very high, so that the surface below it is wider than that above, and the mandibular condyle is drawn upward even less than in "*Pseudalopex*." Although the angle is broad as in *Cerdocyon*, it is not so abruptly elevated and the coronoid is quite different, being rounded in front; making it subtriangular as in *Pseudalopex* rather than tetragonal as in *Cerdocyon*. In all three skulls, apparently adult males, there is a well developed sagittal crest with no suggestion of a parietal expansion. The second lower molar is much enlarged with the result that the ratio between the length of the lower carnassial and that of the combined second and third molars is about the same as in *Lycalopex* although for a different reason. In *Lycalopex* the ratio is governed by reduction of the carnassial whereas in *microtis* it depends upon enlargement of the second molar.

In 1914 (p. 356) Thomas wrote: "The skull of *C. mimax* in some respects approaches that of the Amazonian *C. microtis*, but the external differences are quite marked." Perhaps for this reason Cabrera placed *microtis* in *Cerdocyon*, but in view of the pronounced disagreement of its mandible it now seems impossible to retain it there. Apparently it should be placed in the group which includes such other distinct species as *culpaeus*, *australis*, and *gymnocercus*. However, it shows some approach to *Cerdocyon* and strengthens the opinion that this should be treated as a subgenus rather than a genus.

An analysis of the group stated in the form of a natural key indicates a progressive reduction in the number of characters common to different sections and probably furnishes a fair approximation of the actual degrees of relationship. Such an analysis, in which current names are used, is as follows:

Sagittal crest in both males and females developed as a ridge; front of orbit far back on the level of the posterior boundary of the first upper molar; frontals wide and flattened, the width across postorbital processes equal to or greater than width of braincase; radius, manus, and pes much elongated; tail short; color distinctive and not conforming to widely prevalent canine patterns. . . . . *Chrysocyon*

Sagittal crest, at least in females, rarely or not developed as a ridge, but flattened and lyrate; front of orbit on the level of the posterior boundary of the upper carnassial; width across postorbital processes always less than width of braincase; legs not especially elongate; color mainly grizzled and conforming in general to widely prevalent canine patterns.

Flattened sagittal area very broad, nearly or quite one-half width of braincase, its outer boundaries heavily ridged or beaded; mandible with a deep angular indentation below the angular process and the condyle both of which are drawn upward. . . . . *Urocyon*

Flattened sagittal area moderate, less than one-half width of braincase, its outer boundaries without ridges; mandible with no more than the even undulation below the angular process as usual in Canidae. . . (Genus *Dusicyon* sensu latu)

Angle and condyle of mandible drawn upwards, the angle relatively broad. *Cerdocyon*

Angle and condyle of mandible normal, the angle usually slender.

Upper carnassial very small in proportion to molars, the "upper molar index" usually more than 150; length of first lower molar about equal to combined length of two posterior molars; upper molars subquadrate or with but little transverse extension..... *Lycalopex*

Upper carnassial larger, the upper molar index usually less than 150; upper molars variable, with considerable transverse extension in some species (*culpaeus*) and considerable approach to the subquadrate condition in others (*sechurae*); length of first lower molar exceeding combined length of two posterior molars.

First lower molar with metaconid but little higher than talonid; color normal except the tail which is white-tipped..... *Dusicyon*

First lower molar with metaconid variable, but usually much higher than talonid and sometimes as high as paraconid; color normal.. *Pseudalopex*

From this it appears that *Chrysocyon* and *Urocyon* stand out as the most highly differentiated forms, *Cerdocyon* and *Lycalopex* are next in importance, while *Pseudalopex* and *Dusicyon* are least of all worthy of separation. A logical nomenclatural treatment, therefore, would be to consider the characters of *Chrysocyon* and *Urocyon* as of generic value, those of *Cerdocyon*, *Dusicyon* and *Lycalopex* as subgeneric, and those of *Pseudalopex* only specific. This leads to the following arrangement in which *Pseudalopex* disappears as a synonym and *Dusicyon*, on account of its priority, becomes the generic name for the majority of the forms.

Chrysocyon brachyurus
Urocyon cinereoargenteus
Dusicyon (*Cerdocyon*) *thous*
Dusicyon (*Dusicyon*) *microtis*
Dusicyon (*Dusicyon*) *australis*
Dusicyon (*Dusicyon*) *culpaeus*
Dusicyon (*Dusicyon*) *gymnocercus*
Dusicyon (*Dusicyon*) *griseus*
Dusicyon (*Dusicyon*) *sechurae*
Dusicyon (*Lycalopex*) *vetulus*

In this list only well established species are considered. Subspecies and supposed species of nominal status which are likely to prove to be subspecies when better known, as well as insular forms of obvious derivation, are omitted. Thus there is no false appearance of great diversity within any restricted group.

Lycalopex, in deference to its rather extreme characters, may be tentatively retained as a subgenus; but it is based upon a single species (*vetulus*) to which considerable approach is shown by *Dusicyon sechurae* and it is doubtful if its recognition, except as a species, has any advantages. In Cabrera's arrangement it is placed alone, with *Cerdocyon* intervening between it and "*Pseudalopex*" to which, as I believe, it is much more closely allied. Although Cabrera may have some other explanation in which I would gladly concur, I have difficulty in avoiding the suspicion that he would have seen the affinity of the species *vetulus* to "*Pseudalopex*" more clearly and would have placed

it accordingly if he had not magnified the importance of its peculiarities by giving it generic rank. In any case the result of his action illustrates the point that the multiplication of genera without the use of subgenera often conceals relationships.

The recognition of a separate subgenus for the Falkland Island *australis* would have the disadvantage of obscuring this animal's obvious derivation from the mainland forms. As an insular species, it is not surprising that it should be well characterized in superficial ways, but in deep-seated characters it seems to conform very closely to those of its mainland allies. The position of the protocone of the upper carnassial is exceedingly variable in all dogs and may be found drawn backward in some subspecies of *Canis latrans* and not in others. The height of the metaconid also is variable and in a large series of *griseus* occasional specimens will be found in which its proportions are nearly or quite as in *australis*. That it is a valid character in *australis* need not be doubted, but a specific rather than a generic character. The large size of *australis* is approached by *lycoides* and, when the disparity in size between *lycoides* and *griseus* is also considered, size alone seems of little importance.

In defense of the arrangement proposed above, it may be added that it is much more discriminating than one in which no subgenera appear. It carries on its face a broader view of the facts, but loses nothing in finer analysis. That such an arrangement is more useful to everyone except the narrowest specialists seems self evident. Admittedly it need not make sacrifices for the layman, but to be successful it should be clear, for example, to such as a paleontologist having only general familiarity with recent forms. It is only to be regretted that there is no formal designation for the group as a whole, since it is scarcely of subfamily rank and can only be referred to awkwardly as "the South American Caninae." It is strange that the same era of vastly increased knowledge of mammalian classification which has recognized and widely utilized the subspecies has been so blind to the advantages of the subgenus. In the other direction, in the classification of higher groups, where paleontology has rendered much refinement necessary, it is no longer possible to deal merely with classes, orders and families, and we have not only the subclass, suborder, and subfamily but also the infraclass, infraorder, and superfamily. Therefore, it is not unfair to say that those who persist in ignoring the subgenus are not only out of step but that they have ceased to classify and are engaged only in naming.

Field Museum of Natural History, Chicago, Illinois.

SOME DISTINGUISHING CHARACTERS OF THE MOUNTAIN GORILLA

By Adolph H. Schultz

In several papers, dealing with the skeleton, the growth, and the body proportions of primates, the author (1927, 1930, 1933) has been able to demonstrate tentatively a considerable variety of apparent differences between the mountain gorilla and the West-African lowland gorilla. In view of the very marked variability of gorillas and on account of the scarcity of available material, particularly of the mountain gorilla, it was not possible to claim that the conditions observed necessarily represent typical and generally prevailing differences. It is the purpose of the present study to collect briefly the more significant differences recorded in previous publications and to test the validity of these differences by means of new observations on additional material.

The new data are based chiefly upon the following specimens: the skeletons of one adult male mountain gorilla and of three adult female and eight adult male lowland gorillas, all in the collection of the Museum of Comparative Zoology, Harvard College. For the generous permission to study this series the author is indebted to Mr. H. J. Coolidge, Jr. In addition use has been made of measurements and observations on the skeletons of five adult male and two adult female lowland gorillas in the U. S. National Museum. Only certain parts of some of these skeletons had been examined by the author for previous investigations. The writer wishes to express his gratitude to Mr. G. S. Miller, Jr. for having been given the opportunity to study this material. The unexpectedly numerous and in general striking differences in body proportions between the adult mountain and lowland gorillas, collected and embalmed on the Columbia University-American Museum African Expedition, are tabulated in this paper. It seemed desirable to attempt to answer the question whether these differences, found in adults (Schultz, 1933), exist also in earlier stages of growth. For this purpose measurements on the following embalmed specimens have been utilized: an infantile male mountain gorilla in the U. S. National Museum and an infantile female lowland gorilla of a very similar stage of development in the American Museum of Natural History, measured by the author with the kind permission of Mr. G. S. Miller, Jr. and of Prof. W. K. Gregory; the fetus of a mountain gorilla at the Riksmuseum in Stockholm and the fetus of a lowland gorilla of closely corresponding age at the University of Amsterdam. The author is greatly indebted to Dr. E. Essen-Möller, who had kindly measured the former fetus with the permission of Prof. I. Broman, and to Dr. W. L. Straus, Jr., who had measured the latter fetus with the permission of Prof. M. W. Woerdeman. All the measurements are taken strictly according to the detailed directions published by the author (1929) in a separate paper. In order to avoid extensive repeti-

tion the reader is referred to that publication for full explanations in regard to the measurements and proportions discussed below.

According to table 1 the two types of gorilla differ appreciably in regard to the frequency of certain variations in the number of vertebrae in the various regions of the spine. The most significant difference is found in the number of thoracolumbar vertebrae, which averages 16.7 in the lowland gorilla, whereas

TABLE 1

Percentage distribution of variations and averages of the number of vertebrae in different regions of the spine

Eighteen new specimens combined with the data published in a former paper by the author (1930, tables IX and X).

REGION OF SPINE	TOTAL OF CASES	NUMBER OF VERTEBRAE					AVERAGE
THORACIC		*12*	*12½*	*13*	*13½*	*14*	
G. beringei	8	38	—	62	—	—	12.6
G. gorilla	92	6	1	84	1	8	13.0
LUMBAR		*3*	*3½*	*4*	*5*		
G. beringei	8	62	—	38	—		3.4
G. gorilla	92	35	1	63	1		3.7
THORACOLUMBAR		*15*	*16*	*16½*	*17*	*18*	
G. beringei	8	—	100	—	—	—	16.0
G. gorilla	96	1	33	1	63	2	16.7
SACRAL		*5*	*6*	*7*	*8*		
G. beringei	8	25	75	—	—		5.8
G. gorilla	68	49	49	1	1		5.6

TABLE 2

Averages (in mm.) of the absolute length of the humerus, the clavicle and the ilium in adult gorillas. Measurements on new specimens combined with data from a former paper by the author (1930, tables XII, XIV and XIX)

SPECIES AND SEX	SPECIMENS	HUMERUS	SPECIMENS	CLAVICLE	SPECIMENS	ILIUM
Gorilla beringei ♂	*4*	422	*4*	184	*4*	263
Gorilla gorilla ♂	*40*	434	*20*	164	*18*	229
Gorilla beringei ♀	*2*	353	*2*	151	*2*	226
Gorilla gorilla ♀	*24*	368	*8*	135	*8*	194

only 16.0 in the mountain gorilla. The former average, based upon 96 specimens, is not likely to become much altered by additional observations, the latter average, however, is merely tentative, though the same variation occurs in every one of the eight specimens thus far examined. Incidentally, in one adult male coast gorilla in the Museum of Comparative Zoology (no. 25949) there are only $6\frac{1}{2}$ cervical vertebrae, since the seventh vertebra bears a well-

developed rib on the right, whereas on the left it shows all the normal characters of a cervical vertebra. In another male lowland gorilla of the same collection (no. 9312) occur eight sacral vertebrae (containing seven sacral foramina on each side). Both these variations have never before been found in any primates except man.

Among the many measurements taken by the author (1930) on the skeletons of adult gorillas there are three which differ to a particularly significant degree in the two types. The averages of these absolute dimensions are listed in table 2. It is seen that, whereas the length of the humerus is shorter in the mountain gorilla than in the lowland gorilla, the lengths of the clavicle and of the ilium are much greater in the former than in the latter. These differences exist in males as well as in females. In this connection it is of interest to

TABLE 3

The averages and ranges of variations of some percentage proportions of the skeletons of adult gorillas

New data combined with those published in a former paper by the author (1930, tables XII, XIV, XIX, XX).

	SKELETAL PROPORTION				
	$\frac{\text{Clavicle length}}{\text{Humerus length}}$	$\frac{\text{Ilium length}}{\text{Humerus length}}$	$\frac{\text{Radius length}}{\text{Humerus length}}$	$\frac{\text{Humerus + Radius}}{\text{Femur + Tibia}}$	$\frac{\text{Ray I of hand}}{\text{Ray III of hand}}$
Specimens	*6*	*6*	*6*	*6*	*5*
Gorilla beringei	**43.3**	**63.0**	**84.9**	**112.9**	**49.8**
	42.0–44.1	58.2–66.9	81.8–88.5	109.6–116.8	48.0–52.0
Specimens	*28*	*26*	*64*	*64*	*16*
Gorilla gorilla	**37.4**	**52.5**	**80.7**	**116.8**	**44.4**
	32.7–40.9	47.4–57.1	75.4–85.2	110.3–123.4	40.6–46.5

record here also the maximum individual variation in the length of the humerus, since it exceeds greatly the corresponding dimension of any other known living or extinct primate. Among 85 adult gorillas (see table 2, the report by Lorenz v. Liburnau, 1917, on 5 "*Gorilla graueri*," and the data by Fick, 1926, on 10 gorillas of unrecorded species and sex) for which the humerus length has been published, the highest value amounts to 491 mm. (*G. gorilla* ♂, no. 23162, Mus. of Comp. Zoology).

Since the humerus is shorter and the clavicle is longer in the mountain gorilla than in the lowland gorilla, it is to be expected that the percentage proportion between the two dimensions differs in the two types of gorilla. That this is actually the case is shown by the figures in table 3. The lowest claviculo-humeral index among the six adult mountain gorillas amounts to

42.0 (a seventh specimen, the sub-adult female, Hopkins collection P. A. L. 7, has an index of 43.0) whereas the highest individual value among 28 adult lowland gorillas reaches only 40.9. Even though the series of mountain gorillas is still very small, it seems unlikely that at least as low an index as 32.7 will ever be found among *Gorilla beringei*, or as high an index as 44.1 among *G. gorilla*. The percentage relation between the length of the ilium and the length of the humerus has so far also proved to be of diagnostic value, since the ranges of variations in the two forms of gorilla do not overlap in the series studied. The two gorillas seem to be separated in regard to still another skeletal proportion, namely, the length of the thumb (ray I) in relation to the length of the hand, as represented by ray III (= total length of metacarpus + phalanges of middle digit). This index varies between 48 and 52 in the mountain gorillas, but between only 40.6 and 46.5 in the western gorillas. The two remaining proportions, listed in table 3, differ in the two forms of gorilla only in their average values. Nevertheless, the distribution of variations demonstrates clearly a difference in evolutionary trends. Thus, all the variations in the relative length of the radius in *Gorilla beringei* lie above the average value of this proportion in *G. gorilla*. In a similar way, no mountain gorilla has as yet been measured in which the intermembral index lies above the average of this proportion for 64 lowland gorillas. The very closely corresponding index, derived from measurements on the outer body (upper arm + forearm length in percentage of thigh + leg length), shows the following values in the embalmed adult gorillas from the Columbia University-American Museum African Expedition: 2 *Gorilla beringei* = 113.5 and 115.1; 3 *G. gorilla* = 116.2, 116.2 and 119.2. In the same specimens the length of the forearm in percentage of the length of the upper arm amounts to 82.9 and 83.4 in the two *Gorilla beringei*, whereas to only 76.8, 77.3 and 79.1 in the three *G. gorilla*. These figures agree also very closely with the data for the corresponding skeletal index (radius length in percentage of humerus length) in table 3.

Differences between the two forms of gorilla in regard to still other skeletal proportions have been discussed in a former paper by the author (1930). The new observations on additional material resulted in such a high variability in these few particular proportions, that the differences found remain unreliable until based upon very much more extensive series of specimens. For instance, the percentage relation between the width of the fossa iliaca and the width of the sacral surface of the ilium averages in 6 adult *Gorilla beringei*, 364.1 and in 19 adult *G. gorilla*, 427.1, but the ranges of variations extend among the former from 283 to 416 and among the latter from 359 to 503.

As shown in a previous publication (Schultz, 1930), the vertebral border of the scapula has a different outline in the mountain gorilla from that in the lowland gorilla. This finding was fully confirmed by the new observations on the skeletons at Harvard College and at the U. S. National Museum. This difference is demonstrated in figure 1. In all the mountain gorillas so far ex-

amined, a short portion of the vertebral border at the root of the scapular spine appears to be pulled outward, since it projects beyond the general direction of this border. More or less as a consequence, the infraspinous portion of the vertebral border is markedly concave. These peculiarities are most likely due to some slight differentiation in the attachment of the rhomboid and anterior serratus muscles.

Some body proportions between measurements on the outer body are listed in table 4. They are the more important proportions which distinguish the

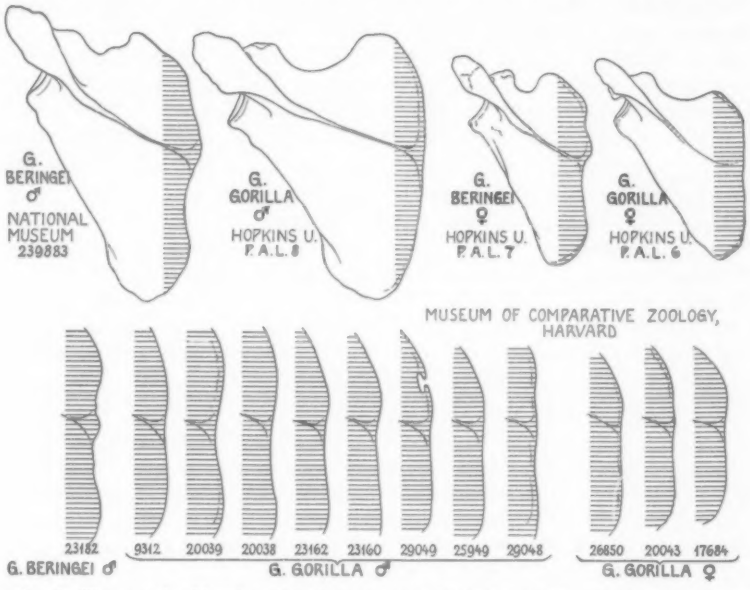


FIG. 1. The vertebral border of the left scapulae of adult gorillas. Upper row, drawn with dioptrograph; lower row, only the vertebral border shown, which was drawn directly along the line of contact with the paper. All scapulae reduced by the same proportionate amount.

two adult mountain gorillas from the three adult lowland gorillas of the Columbia University-American Museum African Expedition. The ranges of individual variations in these two small series of adults do not overlap. These differences have gained in significance by the finding that they appear to exist already in early stages of growth, though in several instances they are less pronounced in fetal or infantile than in adult life. As in all other primates, many proportions of the gorilla change continually and markedly during growth. For instance, the relative height of the upper face increases in *G. gorilla* from 41 in a fetus to 64 in an infant and to 82 in adults. These normal growth changes preclude the use of data on individuals of differing ages in

calculating total ranges of variations for all the available specimens of the two types of gorilla.

According to the figures in table 4, the mountain gorilla in comparison to the lowland gorilla shows at all the stages of growth for which material could be examined, the following peculiarities: (1) the hips (between great trochanters) are narrower in relation to the height of the trunk (from supra-

TABLE 4

Some body proportions in gorillas

New data for infants and fetuses and, for comparison, the figures for adults condensed from the author's former paper (1933, table X).

PROPORTION	2 ADULT MALE *G. beringei* Average Min.-Max.	3 ADULT MALE *G. gorilla* Average Min.-Max.	INFANT MALE *G. beringei* 589 mm. S.H. Nat. Mus. 257504	INFANT FEMALE *G. gorilla* 500 mm. S.H. Amer. Mus. 1216 C. A.	FETUS *G. beringei* 209 mm. S.H. Stockholm	FETUS *G. gorilla* 170 mm. S.H. Amsterdam
Hip breadth	57.8	66.6	54.1	59.1	54.4	63.9
Trunk height	57.0–58.6	65.1–68.3				
Position of nipples	87.3	76.8	85.2	76.8	83.5	83.3
Trunk height	87.2–87.4	76.7–76.8				
Length of neck	28.2	38.7	26.0	34.8	38.8	55.5
Trunk height	27.0–29.4	37.1–40.0				
Total lower limb length	112–4	131.5	110.0	129.5	117.5	145.8
Trunk height	109.2–115.6	128.4–136.0				
Total upper limb length	153.7	183.6	147.0	186.7	178.5	208.3
Trunk height	147.8–159.6	180.3–187.5				
Upper arm length	65.4	79.1	58.5	75.1	72.8	77.8
Trunk height	63.1– 67.8	77.7– 81.7				
Hand breadth	58.5	48.6*	53.2	41.3	57.5	47.2
Hand length	58.1– 59.0	45.0– 50.4				
Length of great toe	88.8	85.5*	87.8	81.5	84.7	82.9
Foot length	88.6– 88.9	84.1– 86.6				
Upper face height	94.6	82.1	64.6	64.2	54.2	41.5
Average head diameter	93.6–95.6	81.3–82.6				
Interocular breadth	19.9	23.0	19.2	20.2	26.4	26.4
Face breadth	19.7– 20.1	22.4– 23.9				

* Averages and ranges of variations of these two proportions are based upon four (instead of only three) adult male *G. gorilla*.

sternal notch to upper edge of pubic symphysis); (2) the nipples are situated higher on the trunk; (3) the neck (projective distance from ear opening to suprasternal notch) is longer in relation to the trunk; (4) the lower limb is shorter in relation to the trunk; (5 and 6) the upper limb and, particularly, the upper arm are very much shorter in relation to the trunk; (7) the hand is broader in relation to the length of the hand; (8) the great toe (from heel to tip of digit) reaches more distally along the total length of the foot; (9) the

height of the face (from mouth to *nasion* point) is greater in relation to the average head diameter (arithmetic mean of head length, breadth and height); (10) the width between the eyes is narrower in relation to the breadth of the face.

All the differences between the two types of gorilla in regard to the proportions which include the trunk height could be explained, at least in part, by the assumption of a particularly great length of the trunk in the mountain gorilla. Such an assumption seems justified by the fact that the trunk height averages 705 mm. in the adult mountain gorillas, whereas only 595 mm. in the adult lowland gorillas. This explanation, however, is incomplete since it has already been demonstrated (see table 2) that the length of the humerus is smaller in *Gorilla beringei* than in *G. gorilla*. It can be concluded, therefore, that such a difference between the two forms of gorilla as that existing in regard to the relative length of the upper arm is due to differences in the lengths of *both* the absolute measurements composing the proportion.

That the humerus of the mountain gorilla is short in contrast to that of the lowland gorilla is a conclusion which is well founded. It has been shown that the humerus of the mountain gorilla is comparatively short in relation not only to the clavicle, the ilium, and the radius (table 3), but also to the height of the trunk (table 4).

The difference in the relative breadth of the hand is due, at least in part, to the comparative shortness of the hand in the mountain gorilla. In percentage of the height of the trunk the hand length averages among adults 33.7 in *Gorilla beringei*, whereas 42.9 in *G. gorilla*. That the hand of the mountain gorilla is proportionately broader than that of the lowland gorilla is shown also by the following additional data: In the sub-adult female mountain gorilla "Congo"[1] the breadth of the hand amounts to 53.2 per cent of the length of the hand, whereas in the juvenile male lowland gorilla "N'gi" (U. S. National Museum, no. 256972) this proportion is only 38.1. These figures agree very closely with the corresponding data in table 4. Incidentally, in the above mentioned sub-adult female mountain gorilla the total length of the upper limb amounts to 154.7 per cent of the trunk height, a value which is practically the same as the average of this proportion for the adult mountain gorillas in table 4.

The relative height of the face is strikingly greater in the mountain gorilla than in the West-African gorilla. That this difference is so little pronounced in the infants, though very marked in the fetuses and the adults, is probably due to the fact that this particular proportion changes unusually rapidly with

[1] This specimen (Hopkins collection, P. A. L. 7) was received when unfortunately already skinned and skeletonized. However, the fresh and still wet skeleton of the trunk had not yet been disarticulated and the hands and feet had merely been slit open in varying extent with the soft parts of only the proximal portion removed. Thus it was still possible to measure the anterior trunk height and the length and breadth of the hand as well as several dimensions on the outer foot.

age and may merely be somewhat accelerated in development in one of the two infants, or retarded in the other. It should be recalled in this connection that Coolidge (1929) has demonstrated on very extensive series of skulls that the palate is considerably longer in mountain gorillas than in lowland gorillas. The longer palate of the former stands most likely in direct correlation to their higher face.

The difference between the two types of gorilla in regard to the relative interocular breadth is not large but, nevertheless, of considerable significance on account of its constancy during postnatal growth. In four juvenile male

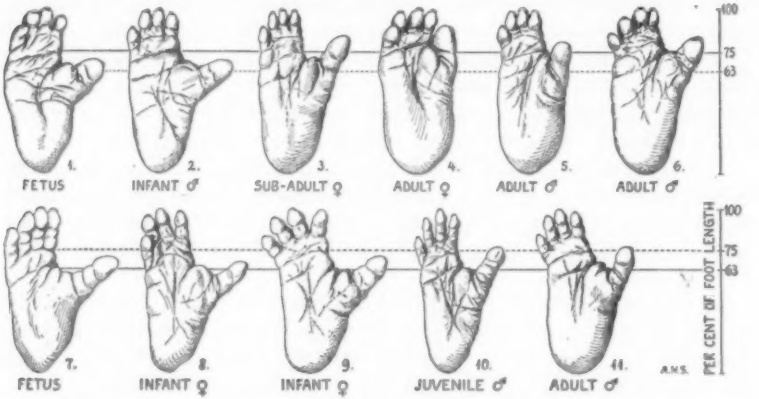


FIG. 2. Right feet of gorillas. Upper row, *Gorilla beringei;* lower row, *G. gorilla.* 1, after photograph sent by Prof. I. Broman, Lund; 2, after photograph of specimen no. 257504, U. S. Nat. Mus.; 3, after photographs, sketches, and measurements of "Congo" (Hopkins, Phys. Anthrop. Lab.); 4, after plaster cast by C. Akeley (reversed); 5, after photograph in The New York Times, Sunday, Dec. 4, 1927; 6, after plaster cast from Amer. Mus. Nat. Hist.; 7, specimen no. 7698, Carnegie Mus.; 8, after plaster cast from Amer. Mus. Nat. Hist. (no. 1105 C. A.) (reversed); 9, after plaster cast of embalmed specimen in Hopkins collection (no. 300); 10, after plaster cast of "N'gi", U. S. Nat. Mus. (no. 256972); 11, after plaster cast of specimen lent by Mus. of Comp. Zool. All drawings reduced to same foot length with pantograph. Plaster casts drawn with dioptrograph.

lowland gorillas (3 embalmed heads from the Columbia University-American Museum African Expedition and specimen no. 256972, U. S. National Museum) the relative interocular breadth has the following values: 20.3; 21.2; 21.7; and 22.2. All these figures are higher than the corresponding indices in the infantile and the adult mountain gorillas in table 4. An analogous difference is found in the data by Weinert (1927) for the relative minimum interorbital width in male gorilla skulls. The average of this index is obtained as 28.0 for 79 West-African skulls, but as only 26.9 for 4 East-African skulls; i.e., the orbits stand closer together in the mountain gorilla than in the lowland gorilla.

It remains to discuss the peculiarities of the foot of the mountain gorilla, which are illustrated by figure 2. The cleft between the first and second toes does not reach as far proximally in *Gorilla beringei* as in *G. gorilla*. This is indicated by the horizontal lines in figure 2 which run approximately through the most distal point at which the free portion of the great toe branches from the sole in the adults. The distance between this point and the heel amounts to about 75 per cent of the total foot length in the adult mountain gorilla, whereas to only about 63 per cent in the adult lowland gorilla. The great toe itself reaches more distally in the mountain gorilla than in the lowland gorilla, as is also shown by the figures for the corresponding index in table 4. Even the length of the skeleton of the great toe is proportionately greater in the former than in the latter. Thus, the total length of the phalanges and the metatarsus of the hallux in percentage of the corresponding measurement on the middle toe averages 72.9 in six *Gorilla beringei*, but only 65.2 in twelve *G. gorilla* (Schultz, 1930, table 31 and new data on three adult *G. gorilla*). In spite of the great length of the first toe or, rather, the great distance to which it reaches, the free portion of this digit as seen on the outer aspect of the foot appears to be proportionately shorter and thicker in the mountain gorilla than in the western gorilla. The detailed differences between the two forms of gorilla in regard to the exact formation of the joint at the base of the hallux have already been discussed by the author in a former paper (1930, table 34 and fig. 22), so that it may be merely mentioned here that these previous findings have been fully supported by the examination of the corresponding features in the gorilla skeletons at the Museum of Comparative Zoology and at the U. S. National Museum.

On the lateral toes (II to V) there also exists a well defined difference between the two gorillas. As shown by the examples in figure 2, the outer digits are proportionately shorter in the mountain gorillas than in the lowland gorillas of corresponding ages. This is largely due to the fact that the sole, or at least what amounts functionally to a sole, reaches farther distally in the former than in the latter. Among 16 specimens (12 embalmed and 4 living animals of varying ages) of *Gorilla gorilla*, carefully examined by the author, the sole reaches in two cases to the middle of the basal phalanges and in all the remaining cases to the distal end of the basal phalanges. The clefts between the lateral toes reach invariably as far proximally as the sole reaches distally and in not a single case is there any true cutaneous webbing between any of the toes. Among seven specimens (3 embalmed and 1 fresh body, 1 plaster cast and photographs of 2 dead animals) of *G. beringei*, on the other hand, the "sole" reaches without exception as far as the middle of the middle phalanges (II, III, and IV, but not V) and in addition at least the second and third toes are more or less extensively fused by webs in four of these cases. In the other three cases the presence of webs could not be determined with certainty. In one instance these webs extend between the second and third and between the third and fourth digits as far as the middle

of the toe nails and in another instance the third and fourth toes are webbed to slightly beyond the base of the terminal phalanges. In two other instances the second and third toes are webbed to the distal end of the middle phalanges.

To summarize, table 5 enumerates briefly the twenty different features discussed in this paper which distinguish the mountain gorilla from the lowland gorilla. In addition there have been listed five more distinguishing characters, named in the conclusions of the monograph on the genus *Gorilla*

TABLE 5

Characters distinguishing the mountain gorilla from the lowland gorilla

1. Greater length of trunk
2. Higher-situated nipples
3. Narrower hips
4. Greater length of neck
5. Shorter lower limbs in relation to height of trunk

5a. Longer lower limbs in relation to length of upper limbs

6. Much shorter upper limbs
7. Broader and shorter hand
8. Great toe reaching farther distally
9. Great toe branching from sole more distally
10. Less convex joint at base of hallux
11. Relatively shorter outer lateral toes
12. Usually webbed toes
13. Higher face
14. Narrower width between eyes
15. Smaller average number of thoracolumbar vertebrae
16. Absolutely and relatively shorter humerus
17. Absolutely and relatively longer clavicle
18. Absolutely and relatively longer ilium
19. Relatively longer radius
20. Peculiarly curved vertebral border of scapula

And according to Coolidge (1929)

21. "Longer palate"
22. "Generally narrower skull"
23. "Thicker pelage"
24. "Large amount of black hair"
25. "Fleshy callosity on the crest" (of the head)

by Coolidge (1929). It is readily admitted that this represents only a provisional tabulation, giving in many instances merely the tentative results of observations on very limited series of specimens. The author is convinced, however, that at least a considerable part of these 25 listed differences are based upon ample evidence, or else are without exception so very pronounced, that no doubt can remain in regard to their significance. It seems unquestionable, for instance, that the mountain gorilla is characterized by a comparatively long palate, by a variety of peculiar conditions of the foot,[2] and by

[2] The foot of the mountain gorilla, just like its hand, seems to be characterized also by specially great width. Among adults the relative breadth of the foot averages 32 in

proportionately short arms. Indeed, the author does not hesitate to call *G. beringei* the *short-armed* gorilla. In view of the tremendous distance between and the striking difference in altitude of the countries inhabited, it is not surprising to find that differing evolutionary trends have been at work among mountain gorillas and coast gorillas. The most interesting conclusion from table 5 consists in the fact that the geographical separation of gorillas is accompanied by a differentiation of not only one or a few features, but of a great variety of characters, appertaining to nearly all parts of the body. That this combination of so many peculiarities entitles the mountain gorilla to the rank of a separate species appears to be a reasonable conclusion, even though it is quite possible that future investigations on additional material will demonstrate that some of the differences found so far are not constant and typical. If some of the conditions, listed in table 5, should prove to be too variable as aids in taxonomic diagnoses, they are, nevertheless, of interest to the student of primate evolution by having recorded the occurrence of extreme variations in one group of gorillas, while having shown their absence in the other.

LITERATURE CITED

Coolidge, H. J., Jr. 1929. A revision of the genus Gorilla. Mem. Mus. Comp. Zool. Harvard, vol. 50, pp. 291–381.

Fick, R. 1926. Massverhältnisse an den oberen Gliedmassen des Menschen und den Gliedmassen der Menschenaffen. Sitzungsber. Preuss. Akad. Wiss., Phys.-mathem. Kl., vol. 30, pp. 417–451.

Lorenz v. Liburnau, L. 1917. Beitrag zur Kenntnis der Affen und Halbaffen von Zentralafrika. Ann. k. k. Naturhist. Hofmuseums, Wien, vol. 31, pp. 169–241.

Schultz, A. H. 1927. Studies on the growth of gorilla and of other higher primates with special reference to a fetus of gorilla, preserved in the Carnegie Museum. Mem. Carnegie Mus., vol. 11, pp. 1–87.

——— 1929. The technique of measuring the outer body of human fetuses and of primates in general. Contrib. Embryol. Carnegie Inst. Wash., vol. 20, (Pub. No. 394), pp. 213–257.

——— 1930. The skeleton of the trunk and limbs of higher primates. Human Biology, vol. 2, pp. 303–438.

——— 1933. Die Körperproportionen der erwachsenen catarrhinen Primaten, mit spezieller Berücksichtigung der Menschenaffen. Anthropol. Anzeiger, vol. 10, pp. 154–185.

Straus, W. L., Jr. 1930. The foot musculature of the highland gorilla (*Gorilla beringei*). Quarterly Review of Biol., vol. 5, pp. 261–317.

Weinert, H. 1927. Die kleinste Interorbitalbreite als stammesgeschichtliches Merkmal. Zeitschr. f. Morphol. u. Anthropol., vol. 26, pp. 450–488.

Laboratory of Physical Anthropology, Johns Hopkins University.

two *Gorilla beringei*, whereas only 28 (27–30) in four *G. gorilla* (Schultz, 1933). It should also be mentioned in this connection that Straus (1930) has reached the following conclusion, based upon detailed studies on the foot musculature of gorillas: "Possibly the little muscle of the deepest plantar layer, which yokes the second and third toes, and which occurs only in the two *G. beringei*, will eventually be found to be a peculiarity of this species."

A NEW SUBSPECIES OF MARMOT FROM COLORADO

By Edward R. Warren

Among other specimens of marmots which I collected in Colorado during the season of 1933 are two from the Wet Mountains which appear sufficiently different from the other marmots of the state to justify their being described as a new subspecies.

Marmota flaviventris notioros,[1] new subspecies

Wet Mountain Marmot

Type.—From near Marion Reservoir or Lake, Wet Mountains, Custer County, Colorado, at about 10,600 feet elevation. No. 4309, ♂ adult, collection of E. R. Warren. Collected by C. J. Tribble, June 26, 1933.

Distribution.—Wet Mountains and Greenhorn Range, in Custer, Pueblo, and Huerfano Counties, Colorado.

General characters.—A large, dark colored marmot, with long, comparatively slender skull, differing from *M. f. obscura* in the dark reddish brown color above, as contrasted with the seal brown of *obscura*, and having the under fur sudan brown instead of Saccardo's umber; the under parts are chestnut and brown, without white-tipped hairs, and *obscura* is blackish brown beneath with white tips to the hairs.

Color.—Type. The general aspect of the animal is dark, with the dorsal hairs extensively white-tipped. Dorsally the color is near bay or chestnut of Ridgway; beneath this is a zone of sudan brown, and the base of the hairs is dusky brown.

Top of head, and side below eyes, are a very dark reddish brown, darker than bay or chestnut. None of the blackish browns quite match it, lacking the slight reddish tinge. There is a white facial stripe or band in the type, wide but not very strong. Chin and sides of mouth quite white, with a trace of a buffy tinge. A nearly black spot on nose below facial band. A buckthorn brown spot behind ear, and side of neck below ear nearly the same, grizzled with white.

Tail full and bushy, darker than bay above; below blackish brown (1). Toes blackish for 35 mm., feet then cinnamon brown toward body.

The sides below are like the back, then the color varies from chestnut on throat, through sudan brown on breast to the posterior fourth of the body, the brown area gradually narrowing, and becoming darker again, shading back to color of throat, and finally, for a very short distance, becoming like the tail.

A topotype, No. 4310, ♀, coll. E. R. Warren, taken July 27, 1933, is like the type dorsally, but lacks the facial band, there being but a few white hairs in its place. The sides of the mouth are buffy, chin quite white, but not extensively so. Tail full and bushy, but here the moult has apparently not been completed. Anteriorly is an antique brown band 50 mm. wide; then a Brussels brown band 25 mm. wide; then another antique brown band 30 mm. wide; then a 50 mm. Brussels brown band; and finally the tip, 30 mm. wide, like upper side of tail of type. Under side of tail blackish brown (1). The under parts have less of a reddish tinge and more of a buff shade than the type, and the dark color of the sides comes farther around toward the median line of the belly.

Skull.—The skull is unusually long and the zygomatic breadth narrow in proportion. The proportion of the zygomatic breadth to the condylo-basal length is 59.59 mm. in the

[1] Greek, νότιος, wet, damp; ὄρος, mountain.

type, and 61.32 in the topotype. This percentage in other species ranges from 62.33 to 68.67 per cent. The rostrum is narrow. The paroccipital process is long and comparatively slender, more the type of the process in *luteola* than in *warreni* or *obscura*. In the type the post palatal length and that of the nasals are the same; in the topotype the nasals are 2 mm. the longer.

Measurements.—Type: Total length, 652 mm.; tail vert., 210; hind foot, 97; ear from notch, 24; condylo-basal length, 99; palatal length, 47.5; post-palatal length, 38; length of nasals, 38; zygomatic breadth, 59; breadth across mastoids, 44; least interorbital breadth, 20; breadth of rostrum, 16; maxillary tooth row, 22; weight, 6 pounds, 14 ounces. Topotype: Total length, 641 mm.; tail vert., 200; hind foot, 84; ear, 29; condylo-basal length, 98; palatal length, 47.5; post-palatal length, 36; length of nasals, 38; zygomatic breadth, 60; breadth across mastoids, 48.5; least interorbital breadth, 21; breadth of rostrum, 17; maxillary tooth row, 21; weight, 8¾ lbs.

Remarks.—This marmot apparently occupies a region isolated from the ranges of the two nearest subspecies of marmots in Colorado. On the north the nearest marmots are found on Pikes Peak and near by, some sixty miles distant; the animals here are the park marmot, *Marmota f. luteola;* to the west the dusky marmot, *Marmota f. obscura*, is found on the high parts of the Sangre de Cristo Range, 35 miles away and separated from the Wet Mountains by the Wet Mountain Valley, twenty miles or more in width.

The highest parts of the Wet Mountains and of the Greenhorn Range, where marmots are to be found, are about twelve miles from northwest to southeast, and of much less width. The greater part of the Wet Mountains to the north and northwest of this is below 9000 feet altitude, and probably does not present the living conditions preferred by these animals.

Comparison of these two specimens with various specimens of other subspecies in my collection shows marked differences in color from any of them. With the exception of *obscura* they are the darkest, and while *luteola* and *warreni* are variable in color, even the darkest are unlike this new subspecies. Ventrally the contrast is very great; *notiorus* is much the darkest, with the exception again of *obscura*.

Although taken only the last of June, both of these animals had already completed the annual moult, with the exception of the tail of the topotype, and the pelage is in splendid condition, dense and long.

The topotype showed no indication of having nursed young that season; the mammæ were not at all prominent, the mammary glands had not functioned, and the animal was getting fat. It was a considerably older animal than the type. Perhaps she was past the breeding age, or perhaps she had had young and lost them early.

1511 Wood Avenue, Colorado Springs, Colo.

DESCRIPTION OF A NEW RACE OF FLYING SQUIRREL FROM ALASKA

By Arthur H. Howell

At the request of Mr. Ernest P. Walker I have examined two specimens of flying squirrels from Prince of Wales Island, Alaska, obtained by him during his residence in the territory, and these appear to represent a form distinct from the race living on the adjacent mainland—*Glaucomys sabrinus zaphaeus*. It may be described as follows:

Glaucomys sabrinus griseifrons, new subspecies

Type.—Female adult, skin and skull, No. 256993, U. S. National Museum; collected at Lake Bay, Prince of Wales Island, Alaska, April 18, 1927, by F. A. Bates; original number, 10.

Subspecific characters.—Similar to *zaphaeus* but upperparts slightly darker; tail, hind feet, and flying membrane darker; underparts more whitish (less buffy); sides of head and neck more extensively grayish.

Description of type.[1]—Upperparts snuff brown; flying membrane chaetura black; front of face between eyes light drab; sides of head and neck clear smoke gray; front feet fuscous; hind feet dark fuscous; tail above, fuscous; tail beneath, fuscous, shaded with light pinkish cinnamon; underparts dull white, washed with drab.

Measurements.—Type (female) and topotype (male): Total length, 322, 306 mm.; tail vertebrae, 147, 140; hind foot, 43, 41. *Skull.*—Type (adult female): Greatest length, 40.8 mm.; zygomatic breadth, 25.1; mastoidal breadth, 18.8; interorbital breadth, 7.6; least postorbital breadth, 9; length of nasals, 13.1; maxillary toothrow, 7.9. Two adult male topotypes: Greatest length, 40.9, 41; zygomatic breadth, 23.8, 24.1; mastoidal breadth, 19.1, 18.3; interorbital breadth, 8.3, 7.2; least postorbital breadth, 10.3, 9.3; length of nasals, 13.5, 13.8; maxillary toothrow, 8.4, 8.1.

Remarks.—Mr. Walker, during a residence of about 13 years in southeastern Alaska, made frequent attempts to obtain records of flying squirrels from Prince of Wales Island, both by trapping for them himself and by inquiring of the resident trappers. In addition to the two specimens mentioned above, he was able to obtain only two reports of their occurrence—one from the fish hatchery on Klawak Lake, near the native village of Klawak, the other from the Hetta Fish Hatchery near the village of Sulzer. From this evidence he considers the animals to be scarce on the Island.

U. S. Biological Survey, Washington, D. C.

[1] Colors from Ridgway, "Color Standards and Color Nomenclature," 1912.

A NEW WOOD RAT FROM SOUTHEASTERN UTAH

By Stephen D. Durrant

When several biologists from the University of Utah visited Castle Valley along the Colorado River in Grand County, Utah, on May 13, 1933, Professor A. M. Woodbury called the writer's attention to the wood rat nests which occurred abundantly on the sage-brush-covered valley floor. Examination showed the nests to be composed of the usual wood rat débris, piled around the bases of bushes and stones. The nests were relatively evenly spaced over the occupied area as though "territory rights" here were observed.

By thrusting aside the débris above ground and digging out the burrows which connected with this, Prof. Woodbury, Mr. James Moffett, and the writer obtained 14 rats in two hours time. In some instances the nest proper was found in the débris above ground, in other instances in the burrows below ground, and in two cases one nest was found in the accumulation of débris above ground and another below in a connecting burrow. Occupied houses could be recognized by their neat appearance and by the presence of freshly cut fragments of an opuntia-like cactus. These fragments were found both on top of the nest and in a surface runway leading to one nest pile.

Study of the specimens in question reveals that they are of the species *Neotoma albigula*, which previously has not been recorded from Utah or from any locality so far north as Castle Valley. These wood rats differ sufficiently from the described subspecies of *Neotoma albigula* to indicate the existence of an undescribed race; this may be known as:

Neotoma albigula brevicauda subsp. nov.

Type.—Male adult, skin and skull; no. 57347, Museum Vertebrate Zoology, University of California; Castle Valley, about 15 miles northeast of Moab, Grand County, Utah; May 13, 1933; collected by S. D. Durrant; original no. 47.

Range.—Known only from the type locality.

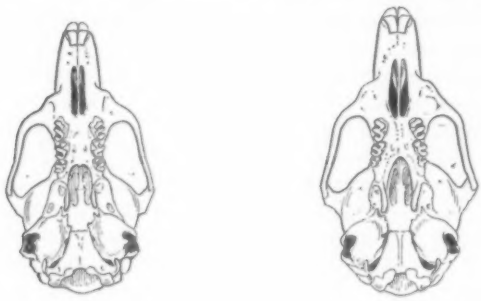
Diagnosis.—A dark colored member of the *albigula* group; tail and hind foot short; ear large; skull with interpterygoid space so narrowly concave as to be almost V-shaped, with the apex of the V extending forward almost to level of anterior border of m^3; incisive foramina long; palatal bridge short.

Measurements.—Average and extreme measurements of five adults from type locality are as follows: Total length, 315 mm. (313–316); tail vertebrae, 126 (118–135); hind foot, 30 (30–32); ear from notch, 29 (27–31). *Skull:* Basilar length, 36.9 mm. (34.5–39.3); zygomatic breadth, 23.1 (22.2–24.2); interorbital breadth, 5.9 (5.5–6.2); length of nasals, 16.5 (15.3–17.9); length of incisive foramina, 9.5 (8.7–10.2); length of palatal bridge, 7.1, (6.9–7.5); alveolar length of upper molar series, 7.8 (7.2–8.4); breadth of rostrum, 7.5 (7.3–7.7).

Comparison.—As compared with February-taken topotypes of *Neotoma albigula albigula* Hartley, May-taken specimens of *brevicauda* are more grayish and less pinkish buff (of Ridgway, Color Standards and Color Nomenclature, 1912); the tail averages only 67 per cent as long as head and body rather than 76 per cent; the hind foot is shorter (30 rather than 32); the ear notch is larger (29 rather than 24); the anterior border of

interpterygoid space is V-shaped, without median spine, rather than U-shaped, with median spine; the incisive foramina are relatively, as well as actually, longer; the palatal bridge is actually, as well as relatively, shorter, averaging only 75 per cent rather than 85 per cent of length of incisive foramina. Examination of specimens of *Neotoma albigula albigula* in the Museum of Vertebrate Zoology from localities in Arizona as far north as the Santa Rita Mountains shows that the differential characters exhibited by topotypes of *albigula* are shown also by the more northern-taken specimens.

From *Neotoma albigula warreni* Merriam, of which one specimen from Gaume's ranch, Baca County, Colorado, has been examined in the present study, along with Goldman's account (North Amer. Fauna, no. 31, pp. 34–35, 1910), the Castle Valley animals are seen to differ in the markedly small hind foot, and shorter tail. The skull of *warreni* is described by Goldman as "closely resembling that of *albigula* but audital bullae decidly smaller, less inflated." *Neotoma albigula brevicauda* has bullae perhaps a trifle less inflated than those of *albigula*. It is inferred, therefore, that excepting the bullae, the skull of *brevicauda* differs from that of *warreni* in the same ways that the skull of *brevicauda* differs from that of *albigula*. Comparison with the single available skull supports this view.



1 2

FIG. 1. *Neotoma albigula albigula*; adult female, no. 24404, Mus. Vert. Zool.; Fort Lowell, Arizona; Feb. 2, 1916.

FIG. 2. *Neotoma albigula brevicauda*; adult male; no. 57347, Mus. Vert. Zool.; Castle Valley, 15 miles northeast of Moab, Grand County, Utah; May 13, 1933. All natural size.

Note in *Neotoma albigula brevicauda* the short palatal bridge, long incisive foramina, V-shaped anterior border of the interpterygoid space, as compared to U-shaped space in *Neotoma albigula albigula*. The anterior border of this space is anterior to the front border of the last molar in *brevicauda*, and posterior to the front border of the last molar in *albigula*.

Compared with *Neotoma albigula laplataensis* F. W. Miller, of which the type and three other specimens from southwestern Colorado have been examined, *brevicauda* differs in the smaller hind foot and the relatively, as well as actually, shorter tail. The skull of *brevicauda* is decidedly larger: Condylobasal length, 42 as compared to 39; zygomatic breadth, 23.1 as compared to 21.3; incisive foramina longer, relatively and actually; rostrum heavier and longer; incisors longer and much heavier; zygomatic process

of squamosal heavy, making a right angle with the jugal, rather than light and with an oblique angle.

Remarks.—One interesting feature of *brevicauda* is the large northward extension of known range that it presents for the *albigula* group. F. W. Miller described *Neotoma albigula laplataensis* from southwestern Colorado; this was previously the most northern record. Miller's specimens and description (Proceedings of the Colorado Museum of Natural History, vol. 12, no. 1, 1933) show a shortening of the tail and hind foot. The Castle Valley specimens show a still more extreme shortening of the tail and hind foot. These Colorado specimens are intermediate geographically and show some intermediate structural characters between *albigula* and *brevicauda*; however, they also have structural characters that separate them from both of those races.

Specimens examined.—Fourteen from the type locality. All, save the type, are in the collection of the Department of Zoölogy, University of Utah, Salt Lake City.

The author is indebted to Dr. E. Raymond Hall, of the Museum of Vertebrate Zoology, for aid in the preparation of this article and for the loan of specimens of *Neotoma albigula*; also to Mr. F. W. Miller of the Colorado Museum of Natural History for the loan of specimens of *Neotoma albigula laplataensis*.

Department of Zoology, University of Utah, Salt Lake City, Utah.

GENERAL NOTES

ALBINISM IN THE CINEREOUS SHREW

On August 5, 1933, near Marcellus, N. Y., while engaged in field work for the Roosevelt Wild Life Station, I secured a strikingly marked albinistic specimen of the cinereous shrew (*Sorex cinereus cinereus*). This animal, which was taken in an ordinary mouse trap of the guillotine type, has a broad band or belt that encircles the body in the region of the fore-quarters. The band has an average width of 14 mm., or approximately one-third of the body length, measured from the posterior edge of the ear to the base of the tail.

On the dorsal side the posterior edge of the white band is practically straight; ventrally it extends some millimeters farther caudad, to about the mid-section of the abdomen. The anterior edge is somewhat uneven, the white approaching the ear more closely on the left side than on the right; on the ventral side the band extends forward to about the middle of the throat, and includes both fore legs and feet. At all points the line of demarcation between the white and the brown is sharp, without any blending.

Although the animal also has a pencil of white hairs on the tip of the tail, this is a feature that was found to be not uncommon in other specimens taken from the same territory and therefore can not be called unusual. As for the body, however, the specimen presents a case of albinism which, so far as my experience goes, is very unusual among our small mammals.—JOHN PEARCE, *Syracuse, N. Y.*

MYOTIS GRISESCENS AND MYOTIS SODALIS IN ARKANSAS

So far as the writer has been able to ascertain from published records, or correspondence with practically all of the leading museums of the country, *Myotis grisescens* is known from Arkansas only through a single specimen in the Museum of Comparative Zoology, Cambridge, Mass., taken on Osage River (Carroll Co.), Arkansas. Correspondence with that institution has failed to supply the date of collection, or the name of the collector. The specimen is listed by Miller and Allen in the recent revision of

the genus (U. S. Nat. Mus. Bull. 144, "The American Bats of the Genera *Myotis* and *Pizonyx*," p. 83).

The same publication (p. 133) lists two specimens of *Myotis sodalis* from Greenway, Arkansas. These appear to be the only specimens of the latter species heretofore known from the state. S. C. Simms, director of the Field Museum of Natural History, Chicago, in which collection the two *M. sodalis* are housed, informs me that both specimens were taken July 10, 1898, by L. Mitchell.

On April 13, 1933, Rev. R. D. Harding, of Gravette, Arkansas, sent the writer 168 specimens of *M. grisescens* taken during hibernation from Crystal Cave, 8 miles northwest of Bentonville, Arkansas. This locality is in Benton County, approximately 17 miles east of the Arkansas-Oklahoma line, and 6 miles south of the Arkansas-Missouri line. This discovery extends the range of *M. grisescens* considerably closer to that of *Myotis velifer incautus* than has heretofore been the case. All of the specimens received from Mr. Harding are now in the Museum of Birds and Mammals, University of Kansas, being preserved as skins, skeletons, and alcoholic specimens in approximately equal numbers.

On June 11, 1933, the writer, accompanied by Miss Ruby Yerton and Hugh Phillips, both of Winslow, Arkansas, visited Dinny Cave, 3 miles east of Alabama, Madison County, Arkansas. Bats had been reported in large quantities from that cave. We found a small colony of *Myotis grisescens* present, all females and young. Of seven females captured, five were nursing one young each, at ages of a few hours to perhaps five days, one was nursing two young about two days old, and the seventh was on the point of giving birth to a single young. The bats flew off in great alarm when spotted by a flashlight, leaving several young hanging to the ceiling where the entire colony was resting when first discovered. All of the *M. grisescens* from Crystal Cave are in the dusky phase, while all those from Dinny Cave are russet. They are indistinguishable from topotype females supplied the museum here by C. E. Mohr of the Reading (Pennsylvania) Museum.

After we had secured our specimens of *M. grisescens*, Phillips found a single bat hanging about ten feet from the colony and secured it without trouble, the animal being in torpid condition quite unlike the *grisescens*. The specimen proved to be an adult male of *Myotis sodalis*. This is apparently the southwestern-most point at which the species has been reported. It was preserved as skin and skull, now no. 9181 in the University of Kansas collection.

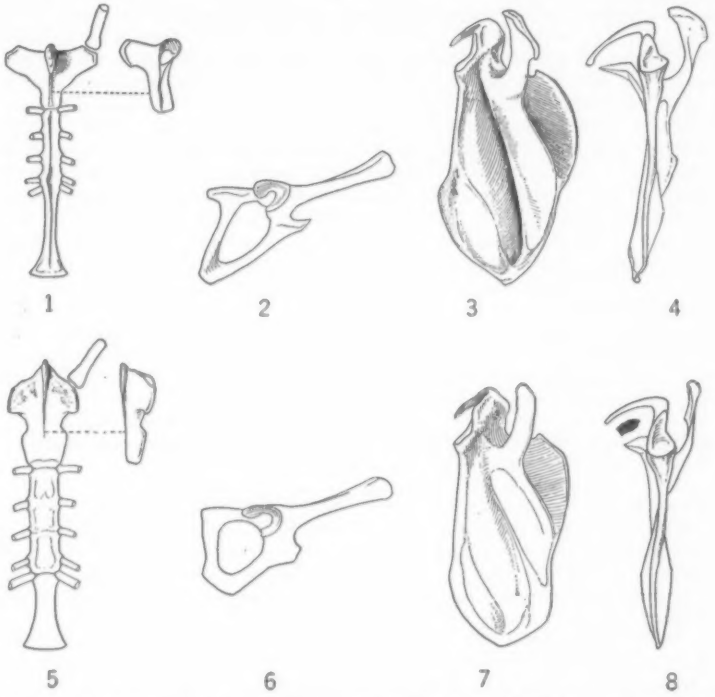
Identification of this specimen has been verified by Gerrit S. Miller, Jr., and Remington Kellogg, of the United States National Museum.—J. D. Black, *Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas.*

CERTAIN OSTEOLOGICAL FEATURES OF EUDERMA MACULATUM

When opportunity recently presented itself, through the courtesy of Mr. Bert Harwell, Park Naturalist, to examine the skeleton of the spotted bat taken in Yosemite National Park, California, by Mr. Robert Selby (see Aschraft, Journ. Mammalogy, vol. 13, no. 2, p. 163, May, 1932), search through the literature for an account of the skeletal features of *Euderma* revealed, in addition to accounts of the skull, only the following observation of Harrison Allen (Proc. Acad. Nat. Sci. Philadelphia, 1891, p. 469; Bull. U. S. Nat. Mus., vol. 43, p. 63): "Atlas with large foramen for vertebral artery which rests on a mere thread of bone; transverse process semicircular without spine. In common with other cervical vertebrae the tubercle on anterior surface of body is marked. Ribs twelve in number. Both presternum and mesosternum keeled. Scapula much as in *Corynorhinus*. It was mutilated in the single specimen examined."

Probably the type specimen examined by Harrison Allen was adult, or at least older

than the Yosemite specimen, which is so young as to lack a keel on the mesosternum. Indeed the sternebrae comprising the mesosternum are barely fused, the mesosternum has not fused with the presternum or xiphisternum, and the distal epiphysis on the femur and humerus, although not separate from the shafts of the bones, are nevertheless recognizable by clearly marked lines of union. Except that our specimen of *Euderma* has eleven instead of twelve ribs and has a scapula different in shape from that of *Corynorhinus*, Allen's description is quite applicable to it.



FIGS. 1–4. *Corynorhinus rafinesquii intermedius* H. W. Grinnell; ♀ ad., no. 49007, Mus. Vert. Zool.; the Needles, 4000 ft., north end of Pyramid Lake, Washoe County, Nevada. 1, ventral view of sternum with lateral view of left side of presternum. 2, lateral view of right side of pelvis. 3, lateral view of outside of left scapula. 4, left scapula viewed from direction of ventral border.

FIGS. 5–8. *Euderma maculatum*, ♂ immature, Yosemite National Park, California. Corresponding views for comparison with *Corynorhinus*. All figures enlarged 3 diameters.

Comparison of the *Euderma* skeleton with those of fourteen adults of *Corynorhinus rafinesquii intermedius* H. W. Grinnell, and two immature individuals of the same species, each slightly younger than the specimen of *E. maculatum*, shows that *Euderma*

differs from *Corynorhinus*, probably the closest American relative, in the following selected features: Presternum with distinct postero-external notch; presternum longer than wide; mesosternum and xiphisternum wider. Scapula: Axillary border hardly produced posteriorly; excluding fossa teres major, two secondary surfaces of infraspinous fossa set at a very slight, rather than a sharp, angle to one another; acromion of uniform width, flattened in a vertical plane and closely paralleling plane of scapula rather than expanded at tip, flattened in a transverse plane, and widely bowed out from scapula. Ischial tuberosity squared rather than extended posteriorly as a distinct process; ischial bar bounding obturator foramen posteriorly, straight with obturator foramen relatively circular in outline rather than with posterior margin of ischial bar convex anteriorly and obturator foramen of triangular outline. See figures 1–8.

Numerous other differences observed between the skeleton of *Euderma* and *Corynorhinus*—for instance, size, shape and angle of articulating facets in the appendicular skeleton and fossae and crests representing extent and kind (tendinous versus fleshy) of muscle attachment—are not clearly to be recognized as "generic" differences with the available material of *Euderma*. Characters correlated with age, sex, or the individual animal may be involved. Similarly, with only one young skeleton of *Euderma*, and without knowledge of the animal's soft anatomy and habits, it has not seemed profitable to dwell on the differences in proportions noted between it and *Corynorhinus*; their meaning is not clear.

In review, the striking nature of the external and cranial characters found by H. Allen (*loc. cit.*) and Miller (Bull. U. S. Nat. Mus., vol. 57, p. 225) to distinguish *Euderma maculatum* from *Corynorhinus* extend also to other parts of the skeleton.—E. Raymond Hall, *Museum of Vertebrate Zoology, Berkeley, California.*

THE OCCURRENCE OF ERETHIZON EPIXANTHUM BRUNERI AND MUSTELA NIGRIPES IN KANSAS

The occurrence of the Nebraska yellow-haired porcupine, *Erethizon epixanthum bruneri* Swenk, has been recorded in recent years within the state. In 1924 Mr. E. H. Hillman collected a porcupine 20 miles southwest of Wakeeney, Kansas, and Mr. Frank Horky of Oberlin, Kansas, collected a specimen in Decatur County, February 15, 1933. These two specimens are now in the University of Kansas Museum of Birds and Mammals.

The porcupine was once common in northwestern Kansas along the Smoky, Solomon, and Republican rivers and their tributaries. These data were given me by the late Prof. H. T. Martin, Curator of the Museum of Vertebrate Palaeontology of the University of Kansas. He said that they were common along these rivers and canyons in the hills where cottonwood-trees were found during the early years of his fossil collecting in that part of the state, but were later killed off by the settlers.

The black-footed ferret, *Mustela nigripes* (Audubon and Bachman) has not been reported as having occurred in the state for many years. The trappers who were once familiar with them state that they are no longer seen. In the winter of 1932 a black-footed ferret was caught in Texas County, Oklahoma, 14 miles south of the Kansas line. Every effort was made to secure this specimen but both skin and skeleton were destroyed.

On July 8, 1933, while collecting fossils in Lincoln County, Kansas, I had the good fortune to meet Mr. C. A. Heine of Lucas, Kansas, who is a close observer of birds and mammals. I learned that since he had lived in that region, where he settled in an early day, he had observed only three black-footed ferrets. The last was in the fall of 1930, when one was run over by a car near his farm east of Lucas, on highway no. 18. The specimen was brought to his home for mounting, as Mr. Heine does taxidermy work.

He gave the specimen, which is in good condition, to the University Museum.—Claude W. Hibbard, *University of Kansas Museum, Lawrence, Kansas.*

A COUGAR ENCOUNTERED IN THE OPEN

The following is one of those exceptional cases where a cougar was seen under wholly natural conditions at close range in the sunshine of June 13, 1933. At an altitude of 2,000 feet, just above Hospital Rock, on the middle fork of the Kaweah River in Sequoia National Park, Mr. R. Allison, while fly-fishing for trout, came face to face with a large male cougar at the river's edge. The animal was first discovered standing in a little sunlit opening amid dry grass at a distance of forty feet from the motionless man. The cougar stared at the human intruder for fully fifteen seconds. Then, when the man shouted, the big cat turned and sprang into the brush where he disappeared and could not again be located. It is believed that this cougar had come down to the river on the hot day to get a drink. I was passing within 100 yards of the scene and verified both the identification of the cougar's tracks and the distance between the cougar and the man.—Joseph S. Dixon, *Wild Life Division, Office of National Parks, Buildings and Reservations.*

ON THE PRIORITY OF SPECIFIC NAMES FOR THE UPPER BRIDGER NOTHARCTUS

While cataloguing the National Museum 1930 collection of Bridger fossil mammals it came to my attention that the date of publication of Leidy's description of the species *Notharctus robustior* was not accurately known beyond that it appeared in the year 1872. Granger and Gregory (Bull. Amer. Mus. Nat. Hist., vol. 37, pp. 854–856, 1917), in revising the genus *Notharctus*, considered *Notharctus crassus* (Marsh) (Amer. Journ. Sci., vol. 4, p. 14, Aug. 7, 1872) and *Notharctus robustior* Leidy as conspecific. In view of the uncertainty as to which name was used first the designation *N. crassus* was selected by them because of its more general usage and because it was founded on a better type. Mrs. Austin H. Clark, Assistant Librarian at the National Museum, found for me through correspondence with Mr. Wm. J. Fox, Librarian at the Academy of Natural Sciences of Philadelphia, that F. V. Hayden's "Preliminary Report of the United States Geological Survey of Montana and Portions of Adjacent Territories" which contains Leidy's description of *Notharctus robustior* (p. 364) was placed in the Library of the Academy on May 7, 1872, thus preceding Marsh's description of *N.* (*Telmatolestes*) *crassus* by at least three months.—C. Lewis Gazin, *U. S. National Museum, Washington, D. C.*

EASTERN EXTENSION OF THE RANGE OF PEROMYSCUS MANICULATUS BAIRDII

Until the present time the prairie deer-mouse, *Peromyscus maniculatus bairdii*, has not been reported from Pennsylvania. R. K. Enders (Occas. Papers Mus. Zool., Univ. Michigan, no. 212, p. 13) collected it in 1926, at Wooster, Ohio. This has until now marked the most easterly point of its range.

In November, 1932, a pair of adult mice of this form and their five offspring were collected by Dr. C. A. Darling in Meadville, Pennsylvania. These mice were found on his property well within the city limits. They were under a bee hive, about 100 feet from any buildings, and over 500 yards from any fields or brush land. Two of the specimens have been deposited in the Museum of Zoology, University of Michigan.

Meadville is in northwestern Pennsylvania, about 20 miles east of the Ohio state line, and more than 200 miles from Wooster, Ohio; thus a decidedly eastward extension of the known range of this subspecies is indicated. Probably this extension is due at least in part to the clearing of the eastern forests and the consequent extension of suitable habitat for the prairie deer mouse.—Alan L. Mitchell, *Laboratory of Vertebrate Genetics, University of Michigan.*

THE TYPE LOCALITY OF PITYMYS PARVULUS

In the original description of *Pitymys parvulus*[1] the type locality was given as Ocala, Florida; later information enables me to fix the locality more exactly as the Lynne Planting Station of the U. S. Forest Service, near the town of Lynne, Marion County. The station is not now in operation.—ARTHUR H. HOWELL, *U. S. Biological Survey, Washington, D. C.*

AGE AND FECUNDITY OF MULE DEER (ODOCOILEUS HEMIONUS HEMIONUS)

In his youth Mr. D. C. Sample, Jr., a Fresno County, California cattleman, used to put his cattle mark on fawns and young deer. In 1910 he stopped this practice as he was convinced that the mutilation caused the untimely death of the youngsters, because few of those marked were ever seen again on the range. He feared that the handling and the blood scent from the clipped ears caused desertion by the doe. One marked individual came to be known year after year in a certain canyon on the range. As Mr. Sample recalls it, this doe had twin fawns yearly for twenty years, from at least as far back as 1910 until her last year, 1930, when she was barren. Her run was in a branch of Blue Canyon, north of the famous Tehipite Dome on Kings River.

The ear mark of Mr. Sample's stock was quite distinctive, being a clipped tip (cut off at right angles) on one side and a "finger" on the other (both edges trimmed leaving vertical "finger"). It may be added that cattlemen in this rough country know just how many cattle they have in each drainage and canyon and in making the frequent counts necessary they rout out much of the game.—ROLAND CASE ROSS, *Los Angeles City Schools.*

MAMMALS FOUND NEAR JARBIDGE, ELKO COUNTY, NEVADA

In view of the dearth of information about the mammalian fauna of extreme northeastern Nevada, it seems worthwhile to place on record a list of the mammals found in the vicinity of Jarbidge, Elko County, Nevada. The opportunity to make observations in this region was afforded during the period, July 14 to 31, 1929, when Lawrence V. Compton and the senior author camped on a small ridge, about 8300 feet altitude, between the heads of Copper Creek and Coon Creek, six miles southwest of Jarbidge, and 14 miles south of the Idaho-Nevada boundary. Unless otherwise stated, the specimens taken, now in the collection of Ralph Ellis, Berkeley, California, were obtained within one mile of our camp.

	Number of Specimens Collected
Sorex vagrans amoenus Merriam	4
Sorex palustris navigator (Baird)	2
Taxidea taxus taxus (Schreber)	1
Canis latrans lestes Merriam	1
Callospermophilus chrysodeirus trepidus Taylor	2
Citellus elegans nevadensis Howell (3 miles north of Jarbidge)	1
Eutamias amoenus amoenus (Allen)—The dark color of the underside of the tail and large size serve to identify our specimens with *E. a. amoenus* rather than with *E. a. monoensis*. Average measurements, in millimeters, of eleven adult and subadult specimens are as follows: Total length, 204; tail, 85.4; hind foot, 32.3; greatest length of skull, 33.4; zygomatic breadth, 18.2; interorbital breadth, 7.7; length of nasals, 10.4	11
Thomomys quadratus fisheri Merriam	9

[1] Proc. Biol. Soc. Washington, vol. 29, p. 83, April 4, 1916.

Perognathus parvus olivaceus Merriam 2
Peromyscus maniculatus sonoriensis (Le Conte) 4
Microtus montanus montanus (Peale) 5
Microtus mordax mordax (Merriam)—Darker colored, with skull less elevated preorbitally than in the case of the Ruby Mountains specimens[1] 3
Zapus princeps nevadensis Preble 11
Erethizon epixanthum epixanthum Brandt 2

Five other mammals seen by us, of which we did not procure specimens, were: yellow-footed marmot (*Marmota flaviventris avara?*), white-tailed jackrabbit (*Lepus townsendii townsendii?*), black-tailed jackrabbit (*Lepus californicus deserticola?*), cottontail (*Sylvilagus nuttallii grangeri?*), and mule deer (*Odocoileus hemionus hemionus?*). Also, on July 14, we found fresh beaver sign at various places along the Jarbidge River, from Jarbidge to the Idaho boundary.—ADREY E. BORELL, *care of Museum Vertebrate Zoology, Berkeley, Calif.*, and RALPH ELLIS, 2920 *Ridge Road, Berkeley, Calif.*

RECENT LITERATURE

Henderson, Junius, and Craig, Elberta L. ECONOMIC MAMMALOGY, pp. x + 397. Charles C. Thomas, Springfield, Illinois, 1932.

Henderson and Craig have written a four hundred page book to provide a condensed summary of economic mammalogy—information mainly not previously available to persons who needed it most. The text is about equally devoted to general discussion and to systematic discussion. References are given fully as footnotes and then summarized in a terminal bibliography, and, finally, they are all included in the index.

In view of the completeness of the references to the Journal of Mammalogy and to certain other types of publications, some of them rather obscure, it is a little surprising and disappointing to find no mention of so many of the few books that deal directly with the problems considered. Such omissions are the two recent volumes by Ritchie, even though these deal primarily with conditions in Scotland, the work of Leopold in this country, the several extensive faunal reports which include important matter of the sort used, the outline of forest and range biology by Taylor (1927), and the several recent texts, such as Elton's, which pertain to mammalian natural history. The scope of undertaking requires that attention be given to general questions as much as to the minutiae of such topics as items of food consumed. Typographical errors occur more frequently than they should, even in a book so filled with citations and cross references. Work by Bonnot in California is ascribed to Dice (p. 243), and the article is entered in the bibliography under both names!

The treatment of subjects, while necessarily abbreviated, seems to be rather too uneven to be fully representative of present-day knowledge. For example, more explicit mention might well have been made of the important uses which have been made of mammals in the biological laboratory. The section on mammals as disease carriers and disseminators is perhaps most inadequate in this respect. Surely, if this subject is to be considered at all it should be summarized on the basis of the latest and best information available; and a few minutes in a library will convince the searcher that there is much suitable information on this topic.

The book will be well worth while if it succeeds in convincing all persons who deal with the wild mammals of our country that "the intelligent understanding and discussion of economic mammalogy involves not only a knowledge of mammals and their

[1] See p. 33.

habits, but also a comprehensive knowledge of zoology in general and botany, sound views on economics and an accurate insight into certain phases of history, politics and legislative principles" (p. 6). Experience in the last two classes is not the only requirement for wise handling of our native fauna.

Also, this great amount of facts should help to dispel the widespread belief that so little is known about our wild life that sound care cannot be given wild animals. Naturally, more adequate knowledge is desirable, but the mere addition or multiplication, however many times, of such facts as are so ably recounted in the present work can have but little importance for understanding the complex web of these interwoven phenomena. Henderson and Craig have done much to show that present needs in economic mammalogy are for clear analysis of and wise use of the information already available in such great quantity; not for multifold effort to increase that quantity.

A compilation of this type tends to bring out in striking fashion the tendency of zoological workers to emphasize the facts which their interests favor. Consequently, it is hard for any compiler to give fair discussion to economic relations if his sources are composed in the proportion of nine papers calculated to demonstrate harmful characteristics of an animal to, possibly, one concerned with impartial analysis of it. Publications dealing with the food of mammals characteristically seem to dwell on hypothetical values to man of some of the items consumed rather than a balanced notion of the normal significance of all the material eaten. Exposition of "the enormous amount of damage done by rodents," apparently, has outweighed by far the meager acknowledgment of possible benefits to human activity from these animals.

Working mammalogists will be grateful to the authors for abstracting and assembling these items from the great mass of materials concerned with the relations of mammals to human welfare. Persons who expect to express opinions in this general field in the future will need to provide themselves with a copy of this guide.—JEAN M. LINSDALE.

Hamilton, W. J., Jr. THE WEASELS OF NEW YORK: THEIR NATURAL HISTORY AND ECONOMIC STATUS. The American Midland Naturalist, vol. 14, no. 4, pp. 289–344, July 1933. Two maps and many illustrations.

The two common eastern weasels, *Mustela noveboracensis* (Emmons), and *Mustela cicognanii* Bonaparte have been given long and careful study, both in their wild state and in captivity, and this study has enabled Dr. Hamilton to put on record much new and valuable information on these important species. The development of the young from birth to maturity and the seasonal changes of pelage are fully described and illustrated with series of photographs. The voices, dispositions, and many of the home habits are described as never before from actual observation. The breeding habits are not yet fully known but the studies are being continued and another season should yield in practically complete form the fundamental information needed. A large number of weasels in the flesh have been examined and the food habits have been studied in the field and in captivity sufficiently to warrant valuable conclusions on the economic status of the animals.

The subject matter is conveniently arranged under headings; there is a brief bibliography and altogether the report is of much interest and practical value.—VERNON BAILEY.

Glaister, John, Jr. A STUDY OF HAIRS AND WOOLS BELONGING TO THE MAMMALIAN GROUP OF ANIMALS, INCLUDING A SPECIAL STUDY OF HUMAN HAIR CONSIDERED FROM THE MEDICOLEGAL ASPECT. Egyptian University, Faculty of Medicine, Publ. 2, Misr. Press., Cairo, pp. 188, pls. 145. 1931.

At first glance the student of mammalian hairs will hail this imposing volume with delight. Here it would seem is a comprehensive and detailed treatment of an im-

portant subject on which there is very little in literature, that is, the taxonomic study of mammalian hairs, other than human. Closer scrutiny of this work of Dr. Glaister, however, soon discloses its superficial character and a thorough study of text and plates proves the whole discourse to be of little worth to the student of hair structure of the lower mammals.

The research worker who uses a compound microscope in studying the characters of mammalian hairs soon learns that identification is possible only with the aid of fine measurements and minute details. Dr. Glaister's much blurred reproductions of photomicrographs, practically devoid of detail, certainly are of no value in the identification of hairs, however valuable they may be from the "medicolegal aspect." The author admits this lack of detail in the photographs (p. 12) and yet states that they reveal as much detail as he could see through the microscope. Furthermore, he says that many of the photomicrographs are of no taxonomic value (p. 156). If so, why cloud the text with their descriptions or clutter up the "Atlas" with their reproduction? A check of the illustrations labeled "microscopic appearance, longitudinally" discloses that out of 545, the author himself labels 266 (47 percent) as of no taxonomic value. Regarding a number of other illustrations the author is "doubtful" of their taxonomic worth; these, as well as many others, the student will put in the "no value" class. For example, plate 2, showing 9 photomicrographs of hair from the spiny anteater, falls in the group that Dr. Glaister gives highest taxonomic rating. A study of the plate, however, shows not a trace of a medulla in any of the illustrations, although on page 51 the author says "the medulla is readily discernible" in 5 of them.

A really worth while part of the book is that devoted to cross-sections of hairs. Many cross-section illustrations are valuable to the student even though the photography fails to bring out details necessary for suitable comparisons.

The arrangement of the book's contents is open to criticism because of the difficulty of attempting to study the plates in conjunction with the text. For instance, plate 2 refers to the spiny anteater but text references for that animal may be found on pages 22, 51, 81, and 157. Moreover, the plates are numbered in two series, the first from 1 to 110, and the second, in partial duplication, from 1 to 35; the plates carry no legends and there are no cross references from plates to text.

The author uses Latin names in classification down to the families and thereafter uses common names only. In some cases such a practice may not be questionable but it certainly is when reference is made to such broad and non-specific common names as "mole," the "common shrew," and "opossum;" the latter name alone may designate any one of at least six genera and two families.

The small part of this book that deals with human hair may be satisfactory from a medicolegal standpoint but certainly the longitudinal plane photographs are of no comparative worth. It is to be regretted that Dr. Glaister's labor on this work and the expense of publishing could not have been supported by good photography or carefully prepared drawings.—CHARLES C. SPERRY.

ABE, YOSHIO. Histologische Untersuchungen des Sommer- und Winterhaarkleides. Journ. Sci. Hiroshima Univ., Japan, ser. B., div. 1, vol. 1, art. 1, pp. 1–32, pls. 1–11. December, 1930.

——— On the Corean and Japanese wolves. Journ. Sci. Hiroshima Univ., Japan, ser. B, div. 1, vol. 1, art. 2, pp. 33–37, pls. 1–5, table. December, 1930.

——— A synopsis of the leporine mammals of Japan. Journ. Sci. Hiroshima Univ., Japan, ser. B, div. 1, vol. 1, art. 4, pp. 45–63, pls. 1–8. March, 1931. (New: *Lepus timidus saghaliensis*.)

ACHARYA, HARI NARAYAN G. Age of animals. Journ. Bombay Nat. Hist. Soc., vol. 35, no. 4, pp. 884–885. July 15, 1932. (Estimates made by Flower, P. Z. S. 1931, not essentially different from those of Hamsadeva, 13th century.)

ADAM, W. G. The queerest little monkey in the world. Field, London, vol. 159, no. 4130, p. 259, figs. 2. February 20, 1932. (The slender loris of Ceylon.)

——— Why the pangolin is hard to kill. Field, London, vol. 159, no. 4146, p. 882, illus. June 11, 1932.

——— The ways of wild boar. Social customs among the pig tribes of Ceylon. Field, London, vol. 160, no. 4154, p. 195, figs. 3. August 6, 1932.

——— Herd habits of the spotted deer. Field, London, vol. 160, no. 4172, p. 888, illus. December 10, 1932.

ADDISON, WILLIAM H. F. The eye glands in the deer family. Report Lab. and Mus. Comp. Path., Zool. Soc. Philadelphia, pp. 26–27. 1933.

AINSWORTH, A. R. The tule elk. California Fish and Game, vol. 18, no. 1, pp. 81–83, fig. 1. January, 1932.

ALLEN, GLOVER M. Geographic variation in the big brown bat (*Eptesicus fuscus*.) Canadian Field-Naturalist, vol. 47, no. 2, pp. 31–32. February, 1933.

AMEGHINO, CARLOS, and CARLOS RUSCONI. Nuevos restos de *Lama guanicoe lönnbergi* (Amegh.). La Semana Médica, Buenos Aires, no. 1, pp. 11. 1933.

AMEGHINO, FLORENTINO. Mamíferos fósiles de la República Argentina. Edición Oficial de las Obras y Correspondencia Científica de Florentino Ameghino (edited by A. J. Torcelli), La Plata, vol. 10, atlas, pls. 98. 1932.

ANDERSON, C. L. Animal activities of the game ranch. Yellowstone Nature Notes, vol. 10, nos. 1–2, pp. 4–5. January–February, 1933.

ANDERSON, FRANK H. An otter loses his dinner to an osprey. Yellowstone Nature Notes, vol. 10, nos. 1–2, p. 7. January–February, 1933.

——— A pugnacious calf moose. Yellowstone Nature Notes, vol. 10, nos. 1–2, p. 3. January–February, 1933.

ANDREWS, ROY CHAPMAN. The Mongolian wild ass. The fleet-footed "kulon" of the desolate plains of Central Asia. Natural History, New York, vol. 23, no. 1, pp. 3–16, illus. January–February, 1933.

(ANONYMOUS). El Professor Lucas Kraglievich. 13 de Marzo de 1932. Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 5, pp. 351–353. (1931) 1932.

——— Range of variation in the leopard. Nature, London, vol. 132, no. 3329, pp. 273–274. August 19, 1933.

——— Two bongo from Sierra Leone. Field, London, vol. 159, no. 4134, p. 409, figs. 2. March 19, 1932.

——— Twelve hundred pounds for two young gorillas. Field, London, vol. 160, no. 4159, p. 372, figs. 2. September 10, 1932.

AVINOFF, A. William Jacob Holland (obituary). Science, n.s., vol. 77, no. 1991, p. 204. February 24, 1933.

BAILEY, VERNON. Live traps for game farms. The Game Breeder, vol. 37, no. 1, pp. 2–3, 20 illus. January, 1933.

——— Cave life of Kentucky. Mainly in the Mammoth cave region. American Midland Naturalist, Notre Dame, vol. 14, no. 5, pp. 385–635, figs. 90. 1933. (With chapters on birds by Florence Merriam Bailey and on invertebrates by Leonard Giovannoli.)

BARNUM, OSCAR L. Breeding habits of mule deer. California Fish and Game, vol. 16, no. 2, p. 184. April, 1930.

BASIR, M. A. The histology of the spleen and suprarenals of *Echidna*. Journ. Anat., Cambridge, vol. 66, pt. 4, pp. 628–648, pls. 1–3, figs. 6. July, 1932.

BECKETT, J. Death of an elephant from rabies. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 242–243. November 15, 1932.

BLANCOU, LUCIEN. Contribution a l'étude de la faune sauvage de l'Oubangui-Chari. Mammifères et oiseaux des bassins de la Ouaka et de la Kandjia (circonscrip-

tion de la Ouaka). Bull. Soc. Recherches Congolaises, Brazzaville, 1933, no. 18, pp. 23. 1933.

Bloss om, Philip M. A new woodrat from southwestern Arizona and a new rock pocket-mouse from northwestern Sonora. Occas. Papers Mus. Zool., Univ. Michigan, no. 273, pp. 5. October 31, 1933. (New: *Neotoma auripila*, *Perognathus intermedius pinacate*.)

Bonnot, Paul. A note on the fishing of the California sea lion. California Fish and Game, vol. 18, no. 1, pp. 98–99. January, 1932.

Botezat, E. Existenţa zimbrului în Bucovina. Bul. Fac. Ştiinţe Cernăuti, vol. 5, no. 2, pp. 370–377, fig. 1. (1931) 1932. (Bison. With German summary.)

——— Neues aus dem Leben des Wolfes und Wildschweines. Bul. Fac. Ştiinţe, Cernăuti, vol. 5, no. 1, pp. 158–168. 1931.

Broom, R. Evolution as the palaeontologist sees it. South African Journ. Sci., Johannesburg, vol. 29, pp. 54–71. October, 1932. (Contains much of real interest, including: "The production of high types of human personality is perhaps the end to which all evolution has been leading.")

Broughton, Lady. Domesticating the African elephant. Field, London, vol. 160, no. 4165, p. 616, illus. October 22, 1932.

Bryden, H. A. The disappearing polecat. Field, London, vol. 160, no. 4158, p. 342, illus. September 3, 1932.

Buffault, Paul. Les loups en France. Rev. Gén. Sci. Pures et Appl., vol. 43, no. 23, pp. 676–681, map. 1. December 15, 1932.

Burke, J. J. Eocene Lagomorpha. Science, n. s., vol. 77, no. 1990, p. 191. February 17, 1933.

Burton, R. G. Old Deccan days. My tiger-hunting journal in 1899. Journ. Bombay Nat. Hist. Soc., vol. 35, no. 4, pp. 761–770. July 15, 1932.

Cabrera, Angel. Los mamíferos de Marruecos. Trabajos de Museo Nac. de Ciencias Nat., Madrid, zool. ser. no. 57, pp. 361, col. pls. 12, figs. 34. December 30, 1932.

Călinescu, R. I. Dihorul de stepă şi distribuţia sa geografică in România. Bul. Soc. Regale Române Geogr., Bucureşti, vol. 51, pp. 107–114, map, pl. 1. 1932. (The steppe polecat and its geographic distribution in Rumania. French resumé.)

Cameron, John. Craniometric memoirs. No. 4. Horizontal zones of the facial norma in modern and fossil man. Journ. Anat., Cambridge, vol. 66, pt. 1, pp. 114–122, pls. 1–4. October, 1931.

Carlisle, T. H. Wild dogs killing by night. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 239–240. November 15, 1932.

Carter, T. Donald. A new flying squirrel of the genus Petaurista from northwestern Siam. Amer. Mus. Novitates, no. 674, p. 1, November 6, 1933. (New: *Petaurista cineraceus stockleyi*.)

Church, Campbell. Whales, grizzlies, and wolves. The Sportsman, Boston, vol. 13, no. 2, pp. 35–47, illus. February, 1933.

Coward, T. A. Wild life 80 years ago—and now. Field, London, vol. 160, no. 4161, p. 448, illus. September 24, 1932.

Dart, F. Sheldon. Those mighty engineers. Yellowstone Nature Notes, vol. 10, nos. 1–2, p. 8. January–February, 1933. (Beavers.)

Davies, W. Maldwyn. Damage to mangolds by rodents [=lagomorphs]. Journ. Min. Agric., Great Britain, vol. 37, no. 3, pp. 269–276, pls. 2. 1930.

Dearborn, Ned. Foods of some predatory fur-bearing animals in Michigan. Univ. Michigan School Forestry and Conservation, Bull. no. 1, pp. 7–25, figs. 8, maps. 1932.

DEGERBØL, MAGNUS. Danmarks Pattedyr i Fortiden i Sammenligning med recente Former. I. Vidensk. Meddel. Dansk Naturh. Forening, København, vol. 96, Festskrift 2, pp. 357–641, figs. 21, pls. 12–24, tables 12. 1933.

DEINSE, A. B. VAN. Aanspoelingen van Cetacea in Nederland in de Jaren 1931 en 1932. Natuurhistorisch Museum te Rotterdam, no. 2, pp. 7–20. 1933.

DIAS, EMMANUEL. On a Schizotrypanum from a bat of Brazil. Mem. Inst. Oswaldo Cruz, Rio de Janeiro, vol. 27, no. 2, pp. 143–146, pls. 29–30. 1933.

DOVER, CEDRIC. The duration of life of some Indian mammals. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 244–256. November 15, 1932.

DUKELSKAIA, N. M., AND V. I. STEPANOVA. Contributions to the knowledge and biology of the hamster (*Cricetus cricetus* L.) and the methods of its control. Bull. Plant Protection, Leningrad, The Lenin Acad. Agric. Sci. in U.S.S.R., vol. 4, no. 2, pp. 55–63, fig. 1. 1932. (Russian text with English summary.)

DUPOND, CH. La propagation du hamster en Belgique. Bull. Mus. roy. d'Hist. nat. Belgique, Bruxelles, vol. 8, no. 26, pp. 43, figs. 9. November, 1932.

EDINGER, TILLY. Zwei Schädelhöhlen-Steinkerne von *Pannonictis pliocaenica* Kormos. Annales Inst. Regii Hungarici Geologici, Budapest, vol. 29, no. 3, pp. 179–184, figs. 3. April 30, 1931.

ELFTMAN, HERBERT OLIVER. The evolution of the pelvic floor of primates. Amer. Journ. Anat., vol. 51, no. 2, pp. 307–339, pls. 1–7. November 15, 1932.

FLETCHER, H. O. Kerguelen Island—its animals and plants. Australian Mus. Mag., vol. 4, no. 12, pp. 401–407, figs. 9. October 16, 1932.

FLOWER, S. S. Breeding season of lemurs. Proc. Zool. Soc. London for 1933, pt. 2, p. 317. June, 1933.

FOLEY, CYRIL. A threatened extermination of bongos in Kenya. Field, London, vol. 159, no. 4130, p. 256, figs. 2. February 20, 1932.

FONTANA, MARIO A. La notable obra geopaleontológica del professor don Lucas Kraglievich. Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 5, pp. 231–261. (1931) 1932. (Biographical sketch, bibliography, and list of new names proposed by Kraglievich.)

FREUDENBERG, W. Die Heppenlochfauna und ein weiterer Beleg des *Inuus suevicus* Hedinger. Paläont. Zeitschr., vol. 14, pp. 126–132, figs. 2. 1932.

FRICK, CHILDS. Childs Frick Tertiary-Quarternary explorations, 1928. Natural History, New York, vol. 29, no. 1, pp. 106–108. January–February, 1929. (New: *Megacamelus, M. blicki, Altomeryx, A. raki, Prochenia* for *Camelus americanus.*)

GEILING, E. M. K., and A. M. DELAWDER. Metabolic changes following the intravenous injection of posterior pituitary extracts and their correlation with the well-known pharmacodynamic actions of the drugs. Bull. Johns Hopkins Hospital, vol. 51, no. 1, pp. 1–26, fig. 1. July, 1932.

——— Changes in total gaseous metabolism of unanesthetized dogs after intravenous injection of posterior pituitary extracts. Bull. Johns Hopkins Hospital, vol. 51, no. 6, pp. 335–345. December, 1932.

GOLDMAN, E. A. New mammals from Arizona, New Mexico, and Colorado. Journ. Washington Acad. Sci., vol. 23, no. 10, pp. 463–473. October 15, 1933. (New: *Thomomys alexandrae, Perognathus amplus jacksoni, Dipodomys spectabilis perblandus, D. s. clarencei, Dipodomys ordii evezus, D. o. cleomophila, D. o. nexilis, Neotoma mexicana inopinata, Neotoma micropus leucophaea.*)

GROLLMAN, ARTHUR, and E. M. K. GEILING. The cardiovascular and metabolic reactions of man to the intramuscular injection of posterior pituitary liquid (pituitrin), pitressin and pitocin. Journ. Pharm. & Exper. Therap,, vol. 46, no. 4, pp. 447–460, fig. 1. December, 1932.

HARNLY, H. J. Vertebrate fossils from McPherson Equus beds. Trans. Kansas Acad. Sci., vol. 35, p. 209. 1932.

HARRIS, WILLIAM P., JR. A new tree squirrel and a new cottontail rabbit from Costa Rica. Occas. Papers Mus. Zool., Univ. Michigan, no. 266, pp. 4. June 28, 1933. (New: *Sciurus variegatoides austini, Sylvilagus floridanus costaricensis.*)

HEARSEY, L. D. W. Tiger killing swamp deer or gond (*Rucervus duvaucelli*). Journ. Bombay Nat. Hist. Soc., vol. 35, no. 4, pp. 885–886. July 15, 1932.

HEATH, ERNEST. Moles: a change of diet? Field, London, vol. 159, no. 4123, p. 15. January 2, 1932.

HENDERSON, JUNIUS, and ELBERTA L. CRAIG. Economic mammalogy. C. C. Thomas, Springfield, Ill., and Baltimore, Md., pp. 397. 1932.

HILL, ETHEL OSBORN. The artful armadillo. Nature Mag., vol. 20, no. 5, pp. 218–219, fig. 1. November, 1932.

HOEPEN, E. C. N. VAN. Voorlopige Beskrywing van Vrystaatse Soogdiere. Paleont. Navorsing Nasionale Mus., Bloemfontaine, vol. 2, pp. 63–65. November 6, 1932. (New: *Gorgon laticornutus, Gazella helmoedi.*)

HOPWOOD, A. TINDELL. Miocene Primates from British East Africa. Ann. & Mag. Nat. Hist., ser. 10, vol. 11, no. 61, pp. 96–98. January, 1933. (New: *Limnopithecus, L. legetet, Xenopithecus, X. korucnsis, Proconsul, P. africanus.*)

HOWELL, A. BRAZIER. Friend badger. Nature Mag., vol. 20, no. 5, pp. 227–228, illus. November, 1932.

INUKAI, TETSUO. A. preliminary note on changes of mammalian fauna since the settlement of Hokkaido. Proc. Imp. Acad., Tôkyô, vol. 8, no. 10, pp. 524–527. December, 1932.

JONAS, LOUIS. The mounting of an elephant group. Publ. Amer. Assoc. Museums, n.s. no. 11, pp. 3–31, figs. 1–42. 1930.

JURGENSON, P. B. Das Hermelin aus dem Turuchansk-Gebiet. (*Mustela erminea ognevi* subsp. nova.). Zool. Anzeiger, vol. 98, nos. 1–2, pp. 11–15. March 1, 1932. (New: *Mustela erminea ognevi.*)

KALABURHOV, N. I. The density of the ground squirrel (*Citellus pygmaeus* Pall.) population in the plague areas of the northern Caucasus and the possibility of its complete eradication. Bull. Plant Protection, Leningrad, The Lenin Acad. Agric. Sci. in U.S.S.R., vol. 4, no. 2, pp. 65–85, figs. 4. 1932.

KLOSS, C. BODEN. Notes on the Malayan races of *Ratufa affinis* (Raffles). Bull. Raffles Mus., no. 7, pp. 1–2. December, 1932. (New: *Ratufa affinis interposita, R. a. frontalis.*)

KOLESNIKOV, I. I. Materials for the study of the significance of some rodents for new rubber yielding cultures. Bull. Plant Protection, Leningrad, The Lenin Acad. Agric. Sci. in U.S.S.R., ser. 4, no. 2, pp. 9–22, figs. 6. 1932. (Russian text with English summary.)

KORMOS, THEODOR. *Pannonictis pliocaenica* n. g., n.sp., a new giant mustelid from the late Pliocene of Hungary. Annales Inst. Regii Hungarici Geologici, Budapest, vol. 29, no. 3, pp. 167–177, pl. 3. April 30, 1931. (New: *Pannonictis, P. pliocaenica.*)

———— Neue pliozäne Nagetiere aus der Moldau. Palaeont. Zeitschr., vol. 14, no. 3, pp. 193–200, figs. 2. March, 1932. (New: *Pliospalax*, for a mandible supposed to represent *Prospalax macoveii* Simionescu, but if specifically distinct to be called *Pliospalax simionescui; Mimomys moldavicus.*)

———— Neue Wühlmäuse aus dem Oberpliocän von Püspökfürdő. Neuen Jahrbuch f. Mineral., Suppl. vol. 69, pt. B, pp. 323–346, figs. 8. 1932. (New: *Allophaiomys, A. pliocaenicus, A. lagurioides, Ungaromys, U. nanus.*)

KORMOS, THEODOR. Baranomys lóczyi n.g. n.sp., új Rágcsáló a Magyarországi felsö Pliocénből. Állatani Közlemények, vol. 30, nos. 1-2, pp. 45–54, figs. 3. 1933. (New: *Baranomys, B. loczyi*. In Hungarian and also in German: *Baranomys lóczyi* n.g.n.sp. ein neues Nagetier aus dem Oberpliocän Ungarns.)

——— Revision der präglazialen Wühlmäuse vom Gesprengberg bei Brassó in Siebenbürgen. Palaeont. Zeitschr., Berlin, vol. 15, no. 1, pp. 1–21, figs. 3. March 31, 1933. (New: *Clethrionomys acrorhiza, Microtus coronensis.*)

——— Die Wölfe des ungarischen Oberpliozäns. Folia Zoologica et Hydrobiologica, Riga, vol. 5, no. 1, pp. 13–35, pl. 1. July 19, 1933. (New: *Canis strandi.*)

KRAGLIEVICH, LUCAS. Contribución al conocimiento de los grandes cánidos extinguidos de Sud America. Anales Soc. Cient. Argentina, vol. 106, pts. 1–3, pp. 25–66, pls. 1–9. July–September, 1928. (New: *Canis gezi, Pseudarctotherium, P. debilis.*)

——— Descripción de un interesante roedor eumegámido descubierto en el Uruguay: *Gyriabrus teisseirei* n. sp. Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 4, pp. 219–224. (1930) 1931. (New: *Gyriabrus teisseirei.*)

——— Hallazgo de un Proterotérido en la República del Uruguay (*Proterotherium berroi* n.sp.). Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 4, pp. 197–203, fig. 1. (1930) 1931. (New: *Proterotherium berroi.*)

——— Sobre *Trigodonops lopesi* (Roxo) Kraglievich. Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 5, pp. 195–200, fig. 1. (1931) 1932.

——— Nuevos apuntes para la geología y paleontología Uruguayas. Anales Mus. Hist. Nat. de Montevideo, ser. 2, vol. 3, pt. 3, pp. 257–321, figs. 12, pls. 46–56. 1932. (New: *Propachyrukhos? schiaffinoi, Stromaphoropsis, S. scavinoi, Castellanosia, C. establei, Eomegatherium nanum uruguayense, Scelidodon corderoi, Menilaus berroi, Toxodontherium listai, Xotoden smaltatus, Berroia, B. gregoriense, Scalabritherium ferreriai, Eleutherocercus vilardeboi, Teisseriria, Stromaphoropsis (Teisseiria) coloniensis, Trabalia, T. guimaraensi, Prolestodon, Lestodon (Prolestodon) atavus, Palmiramys, Palmiramys waltheri.*)

——— Contribución al conocimento de los ciervos fósiles del Uruguay. Anales Mus. Hist. Nat. de Montevideo, ser. 2, vol. 3, pt. 3, pp. 355–438, figs. 9, pls. 60–66. 1932. (New: *Morenelaphus (Pampacocervus) mayi.*)

——— *Megatherium lundi seijori*, nueva subespecie Pleistocena del Uruguay. Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 5, pp. 81–89, figs. 2. (1931) 1932. (New: *Megatherium lundi seijori, Pseudomegatherium* for *Megatherium medinai* Philippi.)

——— (1886–1932) [Obituary notices by Rodolfo Senet, Nicolás Lozano, Ángel Cabrera, Claro C. Dassen, and Cándido Villalobos Domínguez.] Anales Soc. Cient. Argentina, Buenos Aires, vol. 113, pt. 4, pp. 179–190. April, 1932.

——— Diagnosis de neuvos géneros y especies de roedores cávidos y eumegámidos fósiles de la Argentina. Rectificación genérica de algunos especies conocidas y adiciones al conocimiento de otras. Anales Soc. Cient. Argentina, Buenos Aires, vol. 114, pts. 5–6, pp. 211–237, figs. 9. November–December, 1932. (New: *Diaphoromys mesopotamicus, Protomegamys coligatus, Eumegamys dubius, Isostylomys ameghinoi, Tetrastylus anguilari, T. robustus, T. intermedius, Gyriabrus rebagliattii, G. indivisus, Phoberomys praecursor.*)

KROGMAN, WILTON MARION. The morphological characters of the Australian skull. Journ. Anat., Cambridge, vol. 66, pt. 3, pp. 399–413, figs. 7. April, 1932.

LAING, HAMILTON M., and RUDOLPH M. ANDERSON. Notes on mammals of the upper Chitina River region, Alaska. Nat. Mus. Canada, Bull. 56, pp. 96–107, 1929.

LA PERSONNE, V. S. Wild dogs hunting and killing by night. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 240–241. November 15, 1932.

LAWRENCE, BARBARA. A new pocket gopher of the genus Orthogeomys. Proc. New England Zool. Club., vol. 13, pp. 65–67. May 8, 1933. (New: *Orthogeomys grandis pluto.*)

LEOPOLD, ALDO. Report on a game survey of the North Central States. Madison, Wisconsin, pp. 299, maps 21, figs. 4. 1931.

LESLIE, JOHN. Liberation of greater horseshoe bats in Co. Monoghan, and other bat notes. Irish Nat. Journ., vol. 3, pp. 222. July, 1931.

LONGSTAFF, T. G. An ecological reconnaissance in West Greenland. Journ. Anim. Ecology, vol. 1, no. 2, pp. 119–142, pls. 6–9. November, 1932.

LÖNNBERG, EINAR. Description of a fossil buffalo from East Africa. Arkiv för Zoologi, Stockholm, vol. 25A, no. 17, pp. 1–32, figs. 2, pls. 3. June 15, 1933. (New: *Bubalus nilssoni.*)

LOO, Y. T. The forebrain of the opossum, *Didelphis virginiana.* Part 1. Gross anatomy. Journ. Comp. Neurology, vol. 51, no. 1, pp. 13–64, figs. 31. October, 1930.

LOOMIS, F. B. The small carnivores of the Miocene. Amer. Journ. Sci., ser. 5, vol. 26, no. 155, pp. 316–329, figs. 10. November, 1933. (New: *Oligobunis gemmarosae, O. vantasselensis, Paroligobunis petersoni, Plionictis sanguinarius, Pachycynodon delicatus, P. harlowi.*)

LOZANO, NICOLÁS. [Obituary notice] Francisco Javier Muñiz (1795–1871). Anales Soc. Cient. Argentina, Buenos Aires, vol. 114, pt. 3, pp. 120–142, with photograph. September, 1932. (Supposed to have collected the material from Argentina described by Blainville in the Ostéographie des mamifères, vol. 4.)

MACINTYRE, DUGALD. Arctic hares in Scotland—amazing increase within living memory. Field, London, vol. 159, no. 4129, p. 223. February 13, 1932.

MADANSINH of KUTCH. A carnivorous bear. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 238–239. November 15, 1932. (Food habits of *Selenarctos thibetanus.*)

MAGNE DE LA CROIX, PAUL. Les deux formes du galop pithécoïde. Anales Soc. Cient. Argentina, Buenos Aires, vol. 113, pt. 4, pp. 150–154, figs. 5. April, 1932.

——— Origen de caballo criollo. Contestación a una crítica. Anales Soc. Cient. Argentina, Buenos Aires, vol. 114, pt. 2, pp. 70–71. August, 1932.

——— Parallèle entre l'évolution locomotrice des vertébrés et celle des articulés. Anales Soc. Cient. Argentina, Buenos Aires, vol. 114, pt. 3, pp. 143–146. September, 1932.

——— Evolución del Galope transverso. Soc. Cient. Argentina, Anal., vol. 113, pp. 38–41. 1932.

MANJIKUL, ARĬANT. Migration of rats. Journ. Siam Soc., Nat. Hist. Suppl., vol. 9, no. 1, pp. 149–150. June, 1933. (*Rattus rattus jalorensis.*)

MAST, JAMES F. Coyote and wildcat trapping. L. R. Morris: Ontario, California, pp. 78, illus. 1932.

MATHIAS, P. and P. RODE. Contribution à l'étude des insectivores. I. Les Insectivores à piquants. Bull. Soc. Zool. France, vol. 55, pp. 429–437, figs. 2. 1930.

MATTHEW, W. D., and C. C. MOOK. New fossil mammals from the Deep River Beds of Montana. Amer. Mus. Novitates, no. 601, pp. 7, figs. 2. March 22, 1933. (New: *Brachyerix, B. macrotis, Brachyerix montanus* on explanation of fig. 1 = *Brachyerix macrotis, Sciurus angusticeps.*)

MCLEAN, DONALD D. The burro deer in California. California Fish and Game, vol. 16, no. 2, pp. 119–120. April, 1930.

MIDDLETON, A. D. The grey squirrel (*Sciurus carolinensis*) in the British Isles, 1930–1932. Journ. Anim. Ecology, vol. 1, no. 2, pp. 166–167, map. November, 1932.

MILLER, FREDERIC W. Two new Colorado mammals. Proc. Colorado Mus. Nat. Hist., vol. 12, no. 1, pp. 1–2. July 22, 1933. (New: *Conepatus mesoleucus fremonti*, *Neotoma albigula laplatacnsis*.)

MIRANDA-RIBEIRO, ALIPIO DE. As pretensas especies de Baleias Lisas do Atlantico. Bol. Mus. Nac., Rio de Janeiro, vol. 8, pp. 1–11, pls. 7. 1932.

MOFFAT, C. B. The long-eared bat. Irish Nat. Journ., vol. 3, pp. 182–185. May, 1931.

MÖNNIG, H. O. *Hypodontus macropi*, n. gen., n.sp., a hookworm of the kangaroo. 15th annual report Director Veterinary Services and Animal Industry, Union South Africa, pp. 303–306, figs. 5. October, 1929.

——— *Filarinema flagrifer* n. gen., n. sp., a trichostrongylid parasite of the kangaroo. 15th annual report Director Veterinary Services and Animal Industry, Union South Africa, pp. 307–310, figs. 5. October, 1929.

——— *Agriostomum equidentatum*, n. sp., a hookworm of the springbuck. 15th annual report Director Veterinary Services and Animal Industry, Union South Africa, pp. 311–316, figs. 8. October, 1929.

——— On a new hookworm, *Ancylostoma martinagliai* from a jackal. Journ. S. African Vet. Med. Assoc., vol. 2, no. 2, pp. 3. 1931.

——— Wild antelopes as carriers of nematode parasites of domestic ruminants. Pt. 1. 17th report Director Veterinary Services and Animal Industry, Union South Africa, pp. 233–254, figs. 25. August, 1931.

——— A second species of the nematode genus Acanthoxyurus. 17th report Director Veterinary Services and Animal Industry, Union South Africa, pp. 269–272, figs. 4. August, 1931.

——— Two new nematodes from the suricat (Viverridae). 17th report Director Veterinary Services and Animal Industry, Union South Africa, pp. 277–282, figs. 8. August, 1931.

——— New strongylid nematodes of antelopes (preliminary notes). Journ. S. African Vet. Med. Assoc., vol. 3, no. 4, pp. 1–5. 1932.

——— Wild antelopes as carriers of nematode parasites of domestic ruminants. Pt. 2. 18th report Director Veterinary Services and Animal Industry, Union South Africa, pp. 153–172, figs. 27. August, 1932.

MORRIS, R. C. Record of big game shot in the Nilgiri area 1905–1931. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 252–253. November 15, 1932.

——— The duration of life of some Indian mammals. Tigers. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 250–252. November 15, 1932.

——— Unerupted tusks of elephants. Journ. Bombay Nat. Hist. Soc., vol. 35, no. 4, pp. 899–891, fig. 1. July 15, 1932.

——— Vitality of bison mauled by a tiger. Journ. Bombay Nat. Hist. Soc. vol. 35, no. 4, pp. 888–889. July 15, 1932.

——— Use of artificial light in panther shooting. Journ. Bombay Nat. Hist. Soc., vol. 35, no. 4, pp. 887–888. July 15, 1932.

NEILSON, M. B. A sanctuary for Australia's "teddy bears." Field, London, vol. 159, no. 4144, p. 809, illus. May 28, 1932. (Koalas.)

NELSON, E. W., and E. A. GOLDMAN. Three new rodents from southern Mexico. Proc. Biol. Soc. Washington, vol. 46, pp. 195–198. October 26, 1933. (New: *Orthogeomys grandis annexus*, *Sigmodon guerrerensis*, *Sigmodon planifrons*. *Sigmodon alleni* is a distinct species of the *fulviventer* group.)

OBER, E. H. The mountain sheep of California. California Fish and Game, vol. 17, no. 1, pp. 27–39, figs. 6. January, 1931.

O'MAHONY, EUGENE. Notes on the mammals of the North Bull, Dublin Bay. Irish Nat. Journ., vol. 3, pp. 199–201. May, 1931.

PATTERSON, BRYAN. The auditory region of the Toxodontia. Field Mus. Nat. Hist., Geol. ser., publ. 305, vol. 6, no. 1, pp. 2–27, figs. 5. January, 1932.

——— A new species of the amblypod Titanoides from western Colorado. Amer. Journ. Sci., ser. 5, vol. 25, no. 149, pp. 415–425, figs. 4. May, 1933. (New: *Titanoides faberi.*)

PAVLOV, M. P. *Palaeomeryx feignouxi* Geoffroy de l'ancien Gouvernement der Kherson. Bull. Soc. Nat. Moscou, Sect. géol., vol. 8, (n.s. 38), pp. 323–327. 1930.

PEACOCK, E. H. The tigress which faced the flashlight. Field, London, vol. 160, no. 4161, pp. 456–458, illus. September 24, 1932.

——— After bison with camera and tripod. Field, London, vol. 160, no. 4166, p. 654, illus. October 29, 1932.

PENDLEBURG, H. M., and F. N. CHASEN. A zoological expedition to Mt. Kinabalu, British North Borneo (1929). Journ. Fed. Malay States Mus., vol. 17, pt. 1, pp. 1–38, pls. 1–8. September, 1932. (Brief notes on mammals observed.)

PETRONIEVICS, BRANISLAV. Aperçu historique sur les homologies de l'insula des mammifères. Archiv. Mus. Nat. Hist. Nat. Paris, ser. 6, vol. 8, pp. 1–59, figs. 1–45. 1932.

PHILLIPS, TRACY. Gorillas in the Empire. A troop which never leaves British territory. Field, London, vol. 160, no. 4149, p. 23, figs. 2. July 2, 1932.

PINTO, R. DE SERPA. Sôbre *"Elephas meridionalis"* cfr. *"antiquus"* do casal do Torquato (Alenquer). Anais Fac. Ciên. Porto, vol. 17, no. 2, pp. 104–106, fig. 1. 1932.

PIVETEAU, JEAN. Les Chats des Phosphorites du Quercy. Ann. Paléontol., Paris, vol. 20, nos. 3–4, pp. 105–163, figs. 15, pls. 7. March, 1932.

PIZEY, R. M. Black leopards. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 236–237. November 15, 1932.

——— Sounds made by gaur or Indian bison (*Bibos gaurus*). Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, p. 243. November 15, 1932.

PLIATER-PLOKOHOTSKIĬ, K. A. Biology of the chipmunk (*Eutamias asiaticus*) in the Pacific Province. Bull. Plant Protection, Leningrad, The Lenin Acad. Agric. Sci. in U.S.S.R., ser. 4, no. 2, pp. 47–53. 1932. (Russian text with English summary.)

POCOCK, R. I. Striped lions and stripeless tigers. Field, London, vol. 159, no. 4127, p. 149, figs. 4. January 30, 1932. (Lion-tiger hybrids.)

——— Is the ferret a domesticated polecat? Field, London, vol. 159, no. 4134, p. 410, fig. 1. March 19, 1932.

——— Sea elephants. Saving the biggest of all seals from extinction. Field, London, vol. 159, no. 4138, p. 577, figs. 2. April 16, 1932.

——— How to recognize the muskrat. Why it is a menace to our countryside. Field, London, vol. 159, no. 4141, p. 688, figs. 3. May 7, 1932.

——— The black and brown bears of Europe and Asia. Pt. 2. The sloth bear (*Melursus*), the Himalayan black bear (*Selenarctos*) and the Malayan bear (*Helarctos*). Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 101–138, pl. 1, figs. 12. November 15, 1932. (New: *Selenarctos thibetanus laniger.*)

——— Worse than the rabbit plague in Australia. The muskrat danger to Britain's canals and water supplies. Field, London, vol. 160, no. 4171, p. 846, illus. December 3, 1932.

——— The civet-cats of Asia. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 2, pp. 423–449, figs. 4. April 15, 1933. (New: *Moschothera* for *Viverra civettina* Blyth.)

PONCINS, VICOMTE EDMOND DE. Menace of the musk rat and the nutria. Field, London, vol. 160, no. 4172, p. 891. December 10, 1932.

READ, R. S. Menace of the muskrat. Serious examples from Canada. Field, London, vol. 160, no. 4173, p. 931. December 17, 1932.

RELTON, E. A. A plea for the nutria. Field, London, vol. 160, no. 4174, p. 966. December 24, 1932.

RIGGS, ELMER S. The geological history and evolution of the horse. Field Mus. Nat. Hist., Dept. Geol., Leaflet no. 13, pp. 54, pls. 19, figs. 4. 1932.

ROTHSCHILD, LORD, and GUY DOLLMAN. A new tree-kangaroo from the Wondiwoi mountains, Dutch New Guinea. Proc. Zool. Soc. London, Pt. 2, 1933, p. 540–541. June 30, 1933. (New: *Dendrolagus mayri*.)

RUSCONI, CARLOS. Nuevos restos de *Brachynasua meranii* C. Amegh. y Kragl. Revista Soc. "Amigos de la Arqveologia," Montevideo, vol. 5, pp. 151–155, fig. 1. (1931) 1932.

RUSH, W. M. Small animal photo-cage. Nature Mag., vol. 20, no. 5, p. 198, illus. November, 1932.

RUSSELL, LORIS S. A new species of Merychippus from the Miocene of Saskatchewan. Canadian Field-Naturalist, vol. 47, no. 1, p. 11, figs. 6. January, 1933. (New: *Merychippus praecocidens*.)

RUSSELL, LORIS S., and R. T. D. WICKENDEN. An upper Eocene vertebrate fauna from Saskatchewan. Trans. Roy. Soc. Canada, Ottawa, ser. 3, sect. 4, vol. 27, pp. 53–65, fig. 1, pl. 1. November 4, 1933. (New: *Hyposodus fastigatus*.)

SĂHLEANU, EMILIAN. Mamiferele stinse din Bucovina. Bull. Fac. Ştiinte Cernăuti, vol. 5, no. 2, pp. 357–369, figs. 8, (1931) 1932. (Extinct mammals of Bukowina.)

SANBORN, COLIN CAMPBELL. Mammals of the Suydam Cutting Sikkim expedition. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 181–187. November 15, 1932.

SCHAUB, S. Säugetierfundstellen in Venezuela und Trinidad. Verhandl. Schweizerischen Naturforsch. Gesell., Aarau, 112 Jahresversammlung, pp. 326–327. 1931.

———*Cricetulus simionescui* sp. nov. Bull. Acad. Roumaine, Bucarest, vol. 14, nos. 9–10, pp. 243–244, figs. 2. 1931. (New: *Cricetulus simionescui*.)

SCHULTZ, ADOLPH H. The hereditary tendency to eliminate the upper lateral incisors. Human Biology, vol. 4, no. 1, pp. 34–40, figs. 5. February, 1932.

SCHWARZ, ERNST. Geschlechtsdichromismus bei Känguruhs und seine Beeinflussung durch Kastration. Biol. Zentralbl., vol. 51, no. 11, pp. 652–656, figs. 4. 1931.

——— Neue diluviale Antilopen aus Ostafrika. Centralblatt für Mineral. Geol., und Paläeont., Abt. B, no. 1, pp. 1–4, figs. 2. 1932. (New: *Adenota recki, Tragelaphus spekii stromeri, Alcelaphus kattwinkeli*.)

SCHWIDETSKY, GEORG. Do you speak chimpanzee? An introduction to the study of the speech of animals and of primitive men. London, George Routledge & Sons, Ltd., pp. 141. 1932.

SETH-SMITH, D. A very strange monkey. Field, London, vol. 159, no. 4134, p. 410, fig. 1. March 19, 1932. (Red uakari.)

SHNITNIKOV, V. N. The mammals of Balkhash part of Turkestan-Siberian railway. Bull. Plant Protection, Leningrad, The Lenin Acad. Agric. Sci. in U.S.S.R., vol. 4, no. 2, pp. 101–110. 1932.

——— Contributions à la distribution géographique du *Spermophilopsis leptodactylus* (Licht). Annales Zool. Mus. Russian Acad. Sci., vol. 22, pp. 224–228. (1917) March, 1918. (In Russian.)

——— Les Mammifères de la Semiretchié. Comptes Rendus Acad. Sci. URSS, pp. 273–286. 1932. (In Russian.)

SODY, H. J. V. The Balinese tiger. *Panthera tigris balica* (Schwarz). Journ. Bombay Nat. Hist. Soc., vol. 36, no. 1, pp. 233–234. November 15, 1932.

SODY, H. J. V. Ten new mammals from the Dutch East Indies. Ann. Mag. Nat. Hist., ser. 10, vol. 12, no. 70, pp. 430–442. October, 1933. (New: *Rattus bartelsi tjibuniensis, R. schuitemakeri, R. concolor lassacquèrei, R. vanheurni, R. rattus moluccarius, R. rattus scepticus, Mus musculus fredericae, Hylomys suillus maxi, Paradoxurus hermaphroditus balicus, Amblonyx cinerea wurmbi.*)

SOS, V. La cueva de Prádena (Segovia). Bol. Soc. Españ. Hist. Nat., vol. 32, no. 5, pp. 261–263. 1932. (Cave deposit with Pleistocene mammals.)

STEHLIN, H. G. Bemerkungen zu einem Bisonfund aus den Freibergen. Verhandl. Schweizerischen Naturforsch. Gesell., Aarau, 112 Jahresversammlung, p. 326. 1931.

——— Eine Giraffidenmandibel aus Nord-Persien. Verhandl. Schweizer. Naturforsch. Ges., La Chaux-de-Fonds, vol. 112, p. 326. September, 1931.

STIRTON, R. A., and V. L. VANDERHOFF. Osteoborus, a new genus of dogs, and its relations to Borophagus Cope. Univ. Calif. Publ. Bull. Dept. Geol. Sci., vol. 23, no. 4, pp. 175–182, figs. 3. July 19, 1933. (New: *Osteoborus* for *Hyaenognathus cyonoides* Martin, *Osteoborus ricardoensis.*)

ST. LEGER, J. A new species of Myomys from South-West Africa. Proc. Zool. Soc. London for 1933, pt. 2, p. 411. June, 1933. (New: *Myomys shortridgei.*)

STOCK, CHESTER. Perissodactyla from the Sespe of the Las Posas hills, California. Contrib. to Paleont., Carnegie Inst. Washington, Publ. 440, pp. 15–28, pls. 4. November 15, 1933. (New: *Subhyracodon kewi.*)

——— Carnivora from the Sespe of the Las Posas hills, California. Contrib. to Paleont., Carnegie Inst. Washington, Publ. 440, pp. 29–41, pls. 3. November 15, 1933. (New: *Pseudocynodictis* (?) *pavidus, Mesocyon baileyi, Hoplophoneus belli, Nimravus meridianus.*)

——— An Eocene Primate from California. Proc. Nat. Acad. Sci., vol. 19, pp. 954–959, pl. 1. 1933. (New: *Chumashius, C. balchi.*)

STUART-WATT, G. Why a lion turned cattle thief. Field, London, vol. 160, no. 4163, p. 548, photo. October 8, 1932.

SWAINSON, LAURANCE. Menace of gray squirrels. Some results of the first year's campaign. Field, London, vol. 159, no. 4142, p. 733. May 14, 1932.

SWARTH, HARRY S. The long-tailed meadow-mouse of southeastern Alaska. Proc. Biol. Soc. Washington, vol. 46, pp. 207–212. October 26, 1933. (New: *Microtus mordax littoralis.*)

TAYLOR, H. A. Stags "fighting" in velvet. Field, London, vol. 160, no. 4156, p. 279, photo. August 20, 1932.

TEILHARD DE CHARDIN, PIERRE, and JEAN PIVETEAU. Les mammifères fossiles de Nihowan (Chine). Annales de Paléontologie, Paris, vol. 19, fasc. 1–4, pp. 1–134, figs. 42, pls. 23. June, 1930. (New: *Equus sanmeniensis, Cervus* (*Elaphurus*) *bifurcatus, Cervus* (*Eucladoceros*) *boulei, Cervus* (*Rusa*) *elegans, Gazella sinensis, Spirocerus wongi, Bison palaeosinensis, Canis chihliensis palmidens, Canis chihliensis minor, Lutra licenti, Mustela pachygnatha, Machairodus nihowanensis.*)

——— Nouvelle étude sur le *Cervus ertborni* Dub. des Argiles de la Campine (1). Bull. Mus. roy. Hist. Nat. Belgique, vol. 8, no. 5, pp. 1–12, figs. 1–5. May, 1932.

TOKUDA, MITOSI. On some rats and mice from the south sea islands (Part 1, *Rattus concolor* group). Annotationes Zoologicae Japonenses, vol. 14, no. 1, pp. 79–86, fig. 1, pl. 5. June 10, 1933. (New: *Rattus micronesiensis.*)

VELLARD, J., et J. PENTEADO. Une queue multiple de Procyon. Bull. Soc. Zool. France, vol. 56, pp. 355–360, figs. 2. June, 1931.

VRIES, TJEERD GS. Birds of the Camargue, France. Ardea, vol. 16, nos. 2-3, pp. 77-106, pls. 2. 1927. (New: *Bos taurus camarguensis, Equus camarguensis;* name for Camargue cattle is valid, but name for Camargue horse is *nomen nudum.*)

WARD, J. D. U. A new trophy for the rifle. Season to be declared for the Spanish ibex. Field, London, vol. 159, no. 4142, p. 733, fig. 1. May 14, 1932.

WELLS, L. H. A note on two baboon crania from Cathkin Peak Forest Reserve, Natal. South African Journ. Sci., vol. 29, pp. 647-650. October, 1932.

WOOD, D. The modern beaver hunters. Hunter, Trader, Trapper, vol. 64, no. 3, pp. 25-26, fig. 3. March, 1932.

YAGI, TEISUKE. *Elephas namadicus* Mak. from Saku, Shinano. Journ. Geogr., Tôkyô, vol. 43, no. 506, pp. 217-222, figs. 5, pl. 6. April, 1931.

YIN, T. H. Sur la découverte d'une faune de Mammifères Quaternaire aux environs de Kharbine. Bull. Geol. Soc. China, vol. 11, no. 2, pp. 155-159, figs. 2. 1931. (Manchuria.)

YOKOYAMA, MATAJIRO. Two transitional forms between man and ape. Pt. 1. Journ. Geogr. Tôkyô, vol. 43, no. 506, pp. 187-191, figs. 4, pl. 5; Pt. 2, no. 507, pp. 247-255, pl. 1, figs. 11. 1931. (Japanese text.) (Résumé of the literature dealing with the Java man (*Pithecanthropus*) and the Piltdown man (*Eoanthropus*).)

ZVEREV, M. D. Mammals in the area of the northern part of the Turkestan-Siberian Railway. Bull. Plant Protection, Leningrad, The Lenin Acad. Agric. Sci. in U.S.S.R., vol. 4, no. 2, pp. 87-100. 1932. (Russian text with English summary.)

OBITUARY NOTICES

HARRY CLAY TREXLER

General Harry Clay Trexler, a charter member of the American Society of Mammalogists, died on November 17, 1933, from injuries sustained in an automobile accident. He was born in Easton, Pennsylvania, April 17, 1854, and received his education in the public schools of Allentown, and at Tremont Seminary, Norristown, Pennsylvania. He was married on January 22, 1885, to Mary M. Mosser, who survives him.

General Trexler was an ardent conservationist. His game sanctuary, located at Schnecksville, about 12 miles north of Allentown, Pennsylvania, known as the Trexler Game Preserve, covers 1,800 acres of land. In 1910, thirteen miles of high wire fence were constructed for protecting elk, deer, buffalo, pheasants, and quail. These animals are flourishing there and groups may be seen throughout the preserve, many parts of which are timbered, while probably two-thirds of it is grass-covered, rolling hills—a delightful and unspoiled country. It is not unusual for one to stand on a hill top and see a herd of buffalo, white-tailed deer, or elk a mile or more away. The preserve contains approximately five hundred elk, a thousand buffalo, and many white-tailed deer, and is visited by thousands of sight-seers.

Along the Little Lehigh River, Pennsylvania, General Trexler developed and improved the trout hatchery, which for many years had been under lease to the State. It is now one of the largest and finest of its kind.

He took a large part in the development of the 12,000-acre game preserve at Hickory Run, now leased by the State of Pennsylvania. For years he also owned a fine ranch at Jackson Hole, Wyoming, the nationally known wintering ground for the greatest elk herds in America.

He was a member of the Academy of Natural Sciences, Zoölogical Society of Philadelphia, Boone and Crockett Club, and many other organizations.—VIOLA S. SNYDER.

BESSIE A. WHITE

Miss Bessie A. White, a member of the Society, who resided at 121 Broad Street, Red Bank, New Jersey, died November 13, 1933. Miss White was keenly interested in mammalogy and at one time was laboratory secretary to Dr. Herbert Fox, at the Laboratory of Comparative Pathology, Zoölogical Society of Philadelphia. She possessed a cheerful and kindly disposition, and will be greatly missed.—VIOLA S. SNYDER.

COMMENT AND NEWS

MEMBERSHIP

Anyone interested in any phase of mammalogy is eligible for membership in the American Society of Mammalogists, and if elected will receive the Society's official publication, the Journal of Mammalogy, quarterly. Name and address, with remittance of $3.00 for annual dues, may be sent to the Corresponding Secretary, or to any officer of the Society. Membership is dated from the nearest January, although formal election will not take place until the annual meeting of the Society following the receipt of application.